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The movement towards the establishment of a new house for the American Society of Civil Engineers, in New York city, has advanced another step, the Board of Direction having entered into an agreement for the purchase of two lots, Nos. 218 and 220 West 57th St., the price agreed upon being $80,000. These lots have a frontage of 50 ft. on the south side of the street, and a depth of 106 ft. on the east, and 114 ft. on the west. Some months ago a circular was issued asking for conditional subscriptions towards a fund for such a purpose, either by offers of cash payments or by offers to take 4% bonds. This circular recommended the purchase of a lot and the erection of a new house at a total estimated cost of about $125,000. At the business meeting of the annual convention, on June 20, a report was presented by the Board of Direction, showing that 278 members (or 15½% of the membership) had sent replies, 97% of these being in favor of a new house, while the amount of subscriptions offered amounted to $13,145 in cash and $39,625 in bonds, or $52,770 in all. At that meeting a resolution was adopted to the effect that the present quarters being insufficient, new and superior quarters should be procured, and the execution of the scheme was entrusted to the Board of Direction. In a circular recently issued it is pointed out that a subscription from the entire membership on the basis of $13,145 from 15½% of the membership would amount to over $80,000, and subscriptions are now, therefore, asked for, in the hope that the proposed issue of bonds may be avoided.

The improvements which should be made in the Northern Pacific R. R. during the next five years will require an expenditure of about $9,000,000, according to the report of the original receivers. The work will include laying 1,400 miles of new rails, at a cost of $4,000,000, including ballasting; $3,600,000 will be required for replacing wooden trestles and bridges with earth fills or steel bridges. The estimate submitted is as follows:

Reducing grades	$1,500,000
Perfecting right of way	385,000
Purchasing tide lands on Puget Sound	100,000
Steel rails (less value of old rails)	2,500,000
Terminal and other facilities	1,000,000
Bridge renewals	3,600,000
Total	$9,085,000

The switching rate of $2 to $3 per car for switching at the stock yards, which is charged to live stock shippers by the railways entering Chicago, has been declared illegal by the Illinois Railroad & Warehouse Commission. The case was one brought against the Chicago & Alton R. R., and it was shown by the evidence that the railway had special pens and chutes for its use and did all its own switching, the Union Stock Yards & Transit Co. having nothing whatever to do with the handling of the cars. The railway, therefore, practically has a terminal at the stock yards, and the extra terminal or switching charge is declared to be illegal and unwarrantable. The railways have been making this charge since Jan. 1, 1894, at which time the stock yards company imposed upon the railways using its tracks a charge of 40 cts. per car. The U. S. Circuit Court rendered a similar decision against the Atchison, Topeka & Santa Fe R. R. in November, 1894.

A double-end express locomotive, with four driving wheels and a leading and trailing pony truck, is being used by the Chicago, Burlington & Quincy R. R. for its mail train service between Chicago and Galesburg, and a six-wheel tender with plate frames is used with it. The leading dimensions are as follows:

Driving wheels	7 ft. ¼ in.
Truck "	4 " 2¼ ins.
Driving wheelbase	7 " 6 "
Total wheelbase	24 " 3 "
Weight on driving wheels	84,000 lbs.
" total	130,000 "
Cylinders	19 × 26 ins.
Steam ports	21 × 1¾ "
Exhaust ports	25½ × 6 "
Piston valves, diameter	10 "
" " travel	6 "
Boiler, diameter	4 ft. 10¾ "
Firebox	8 ft. 10¾ ins. × 5 ft.
Tubes, No.	210; diameter 2 ins.
" length	12 ft. 9 ins.

The International Tramway Union will hold its next meeting in Stockholm, Sweden, in 1896. The subjects to be discussed are as follows: 1, The use of barley for horses' food; 2, Food and rations for car horses; 3, The use of turntables to replace sharp curves; 4, The comparative advantages of laying the tracks of country lines and secondary railways on the highways or upon their own land; 5, Union stations and the joint use of tracks; 6, Length of trains on steam tramways and secondary railways; 7, Removal of snow; 8, Track for lines employing mechanical traction; 9, Mechanical motors for street railways and country tramways; 10, Electric power plants and cost of operating such plants; 11, Effect of electric railways upon telegraph and telephone lines, water and gas mains, etc.; 12, Shops and car sheds for electric railways; 13, The comparative advantages of stopping cars at certain points only or at any point desired by a passenger; 14, Speed of street cars; 15, The respective sizes of the body and platforms of street cars; 16, Car fenders.

The New York Rapid Transit Commission can have its three commissioners to decide whether or not the railway should be constructed. They will be appointed by the Supreme Court. The lower courts held that application for their appointment should be made to the Appellate Division of the Supreme Court, which has no existence until Jan. 1, 1896. All the judges of the Court of Appeals now decide that the new constitution does not abridge any of the powers of the General Term until after the Appellate Division comes into existence. The Supreme Court can, therefore, at once act upon the application for these commissioners upon its merits.

The estimates of the Street Cleaning Department, New York city, presented by Colonel Waring this week, amounted to $3,187,052, but the Board of Estimate and Apportionment cut this down to $2,715,700. The amounts allowed include $210,700 for salaries, $1,200,000 for street sweeping, $800,000 for carting and $375,000 for final disposition.

The most serious railway accident of the week was a collision on the Grand Rapids & Indiana R. R., at Ceylon, Ind., Oct. 18. A bridge gang had switched its car onto a sidetrack to let the pay train pass, but failed to close the switch, and the train running at high speed was wrecked on the sidetrack. Three men were killed and several injured.—On Oct. 16 a head collision occurred at Allegheny Furnace, near Altoona, Pa., on the Pennsylvania R. R. A train of tank cars, which had been taking water to supply some of the towns suffering from a water famine, was standing on the main track during its switching movements, when it was struck by a local passenger train for Henrietta. Two trainmen were killed and four were badly injured. None of the passengers were injured.—On Oct. 16 an open switch on the Long Island R. R., near Amagansett, on the Montauk extension, caused a construction train to run into a flat car loaded with rails. Five men were badly hurt.

An open drawspan on the Belleville branch of the Grand Trunk Ry., from Belleville to Peterboro, Ont., caused a passenger train to run into the Ontonabee River, Oct. 10. Several persons were injured, but none seriously.

An explosion of gas under the sidewalk of Fifth Ave., New York city, on Oct. 16, smashed the sidewalk and did considerable damage to the lower part of one of the houses. It is said that a gas main of the Consolidated Gas Co. had been leaking for some time, and that an electric spark probably caused the explosion.

A break in the water supply main from the pumping station to Atlanta, Ga., on Oct. 18, necessitated shutting off the water for a time to put in a new section of pipe, 30 ins. diameter and 12 ft. long. The break was at first temporarily repaired by bolted sleeves kept for the purpose. Electrolysis is given as the cause of the accident.

A steam pipe explosion took place in the Spring Garden pumping station of the Philadelphia waterworks on Oct. 19. The explosion knocked out a portion of the end of the boiler house, causing damage estimated at $1,000, but no one was injured. The accident will cause the shutting down for a few days of pumping engines of 60,000,000 gallons daily capacity, but as there is abundance of water now in the reservoirs no shortage of the water supply will ensue. The portion of the pipe that exploded was a brazed copper bend or goose neck 14 ins. diameter and 3-16 in. thick. It failed in the brazing, as brazed copper steam pipes frequently do.

The battleship "Indiana" made an official trial run, on Oct. 18, between Cape Ann and Boone Island, a distance of 31 knots. The average speed was 15.61 knots per hour for four hours, and she gains a premium of at least $50,000, at the rate of $25,000 for every quarter knot over 15 knots. The run to Boone Island was made against the tide, but under favorable weather conditions, at the average rate of 15.24 knots per hour; on the return the average speed for the 31 knots was 15.99 knots, with a record of 16.30 for the last knot made. During the last 15 minutes, under forced draft, 11,800 HP. was developed; the maximum revolutions of the screws were 131, and the average between 128 and 131; the average steam pressure was 165 lbs. at the boilers and 161 lbs. at the engines; the average water pressure in the fire-rooms was 1 in., and average temperature 105°. After the official trial the "Indiana" was turned in a circle of 400 yds. diameter.

The Russian torpedo-boat destroyer "Sokol," built by Yarrow & Co., of England, has developed an average speed of 29.773 knots per hour over a course of 6 miles, and 30.102 knots over 3 miles. The "Sokol" is 190 ft. long, and developed about 3,700 HP. with 160 lbs. of steam pressure and 405 revolutions per minute. Her engines are capable of developing 4,400 I. HP., however, and she may yet surpass the record given above. The English torpedo-boat destroyers "Havock," "Hornet" and "Ferret" have about the same dimensions as the "Sokol." The "Havock," with 169 lbs. of steam, 388 revolutions and 4,000 I. HP., made an average of 26.18 knots on her trial trip. The "Ferret," with 172 lbs. steam pressure, 363 revolutions and 4,507 I. HP., made an average of 27.61 knots in a six-mile run, with a spurt of 28.346 knots. The "Hornet," which is a twin to the "Havock," made an average of 27.31 knots, with a spurt of 28.48 knots. The "United Service Gazette," of London, claims that the "Sokol's" record is the first to pass the 30-knot limit; but according to French accounts, the twin-screw torpedo-boat destroyer "Forban" made an average speed of 31.029 knots, in September last, at Cherbourg. The length of course is not stated.

A free bridge across the Mississippi River at St. Louis, Mo., is being advocated by the St. Louis Manufacturers' Association, the agitation having gone so far, it is stated, that a charter is being drawn for submission to the City Council. It is calculated that the new bridge will cost about $3,000,000, exclusive of terminals, which will cost $5,000,000 more. The present charter of the Eads bridge prohibits the construction of another bridge within two miles, either up or down the river. This charter will expire in about nine months, and then another bridge can be built at any place the people may choose. The site said to be selected for the new bridge is close to the present Eads bridge. Free bridge schemes have long been favorite subjects for public discussion in St. Louis, and it is doubtful whether anything substantial will result from the present agitation.

CONCRETE FOOT WALL, QUEEN LANE RESERVOIR REPAIRS, PHILADELPHIA.

The ingenuity of the engineer is often more severely taxed to devise methods of repairing structures which have failed than in designing new ones of the same class. This is especially true of leaky reservoirs. A contract for some interesting work of this character was recently let at Philadelphia, as noted briefly in our issue of Oct. 10. The expert's report on the best method of repairing this structure was abstracted in our issue of Aug. 15, 1895.

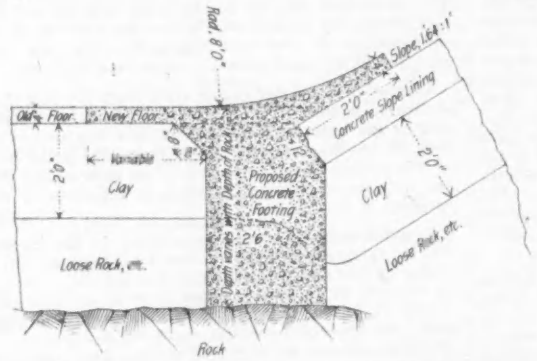


Fig. 1. Concrete Footing Course for Repairing Queen Lane Reservoir, Philadelphia Water Works.

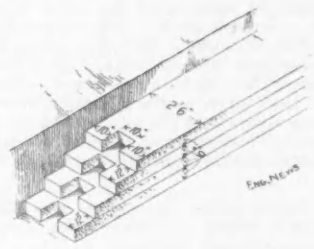


Fig. 2. Arrangement of Concrete Layers in Footing Course for the Queen Lane Reservoir Repairs.

The construction of the Queen Lane reservoir for the Philadelphia water-works was begun in the fall of 1892, under a contract for $1,159,000. The reservoir was designed for a capacity of 386,000,000 gallons, with two basins, each about 700 × 1,100 ft. over all, but the south basin being only some 500 ft. wide for about half its length. When water was pumped into the reservoir serious leaks appeared, which the repairs now started are designed to prevent. The footing course described below is peliminary to the possible use of an asphalt lining, as recommended by the experts in the report cited above. We are indebted to Mr John C. Trautwine, Jr., Assoc. Am. Soc. C. E., Chief of the Philadelphia Bureau of Water, for the drawings from which the accompanying illustrations were made and also for a copy of the specifications for the work. Mr. Thos. M. Thompson is Director of the Philadelphia Department of Public Works.

The general form and dimensions of the footing course are shown by Fig. 1, and the arrangement of the concrete layers as deposited in the trench by Fig. 2. The dimensions vary with the extent of the cracks at the foot of the slope, and with the depth at which rock occurs. Only the south, or irregular-shaped, basin is to be treated under the present contract, but this involves a length of about 3,600 ft. of footing-course. The following facts regarding the work are extracted from the specifications:

The cutting of the old concrete lining must be done by means of picks, chisels or other pointed or edged tools. Machinery may be used, subject to the approval of the engineer.

The cement for the concrete shall be either American or European Portland, to be approved by the engineer. It shall have a specific gravity of not less than three. It shall not leave more than 1% residue by weight on a No. 50 sieve; 15% on a No. 100 sieve, and 40% on a No. 200 sieve. The concrete shall be composed of 4 parts of broken stone 1 to 1½ ins. in greatest dimension, 2 parts gravel, 1 part each of sand and cement.

In addition to the above the specifications are quite full as regards tests of the cement, and the character of the various parts of the work.

The contract for the work was awarded to the Pennsylvania Asphalt Paving Co., the lowest of twelve bidders, at the following prices: Removing floor lining, 10 cts. per sq. yd.; removing slope lining, $1 per sq. yd.; excavating trench, 40 cts. per cu. yd.; concrete in place, $5.50 per sq. yd.; time for completion, 20 days. The prices named by the other bidders for excavation and concrete were given in our Construction News Supplement for Oct. 10, 1895.

THE REMOVAL OF GRADE CROSSINGS IN BUFFALO, N. Y.

(With Inset.)

The question of abolishing grade crossings of streets and railways in Buffalo has been one that has engaged the attention not only of the citizens, but of the railway companies as well for a number of years. The rapid growth of the city in the past ten years, and the many railways which have entered the city within that time, and their desire and need to reach the water front, have developed a complication in track location difficult to satisfactorily meet and overcome in treating the grade crossing problem. Many railways now cross each other at grade, and over their tracks are the elevated tracks of the Delaware, Lackawanna & Western R. R. Co. and the Lehigh Valley R. R. Co., and the streets are crossed by all of the roads at various angles. To further complicate matters, the local freight yards and houses of most of the roads are near to or adjoining their passenger stations. Within a circle having a radius of 1½ miles there are nearly 400 miles of tracks, owned and operated by 15 different railway companies, and crossing and interlaced with each other in every conceivable direction.

The first move toward abolishing grade crossings in Buffalo was the preparation of a plan by Peter Emslie, Esq., City Surveyor, in 1856, when the population was but 65,000, providing for a bridge or viaduct over the four tracks of the New York Central R. R. at Michigan St. The bridge was to be of wood, with an approach on the north side having a grade of 8%, and one on the south side with a somewhat lighter grade. The next attempt at getting relief was for the crossing at William St., on the New York Central R. R., when the Chief Engineer, in 1874, prepared a plan for a bridge or viaduct to span some 13 tracks. The structure was to be a suspension bridge with approaches carried on the shore ends of the cables, except for about a third of the distance, which was of solid masonry and served the purpose of anchorage for the cables. The failure to have this plan executed was due to the unwillingness of the railway company to commence work of this kind and the lack of power on the part of the city to force it to do so. In the mean time the city had grown to a population of 132,600.

From 1874 to 1887 spasmodic and intermittent discussion and agitation of the subject appeared in the daily papers, and it was talked of by the citizens generally whenever it was prompted by the occasional killing or maiming of persons at a crossing. This continued until the fatal accidents became so frequent that forbearance ceased to be longer possible, and in 1887 the Lumberman's Exchange, the Common Council and the newspapers took up the matter in earnest, resulting in an application to the State Railroad Commissioners for recommendation from them of a plan of relief. A public hearing was in consequence held in Buffalo on June 7, 1887, at which meeting the city in its corporate capacity, the Lumber Exchange, Merchants' Exchange and citizens in interest were numerously represented. Immediately subsequent to this meeting, Thomas W. Spencer, the Inspector of the Board of Railroad Commissioners, was sent to Buffalo to make a careful investigation, surveys and drawings of the crossings of Washington, Michigan, Chicago and Louisiana Sts., and prepare a plan to remedy the evil. Mr. Spencer's report was presented to the Board July 26, 1887, and was made a part of the Commissioners' report. On Oct. 19 of the same year a hearing on the plan was held in Buffalo. The plan in brief was the elevation of the passenger and freight tracks leading to the lower freight depot of the New York Central & Hudson River R. R. Co., the passenger tracks and carload freight tracks of the New York, Lake Erie & Western R. R., and the passenger tracks of the Lake Shore & Michigan Southern R. R. from Washington to Alabama Sts., between Exchange St. and the Hamburg Canal. The railway companies in a report signed by Walter Katte, Chief Engineer, N. Y. C. & H. R. R. R.; C. W. Buchholz, Chief Engineer, N. Y., L. E. & W. R. R.; G. R. Hardy, Chief Engineer, Lake Shore & Michigan Southern R. R. and D. M. McCreary, Engineer of Maintenance of Way of the Buffalo, New York & Philadelphia R. R., totally disagreed as to the plan of elevation of the tracks as proposed, but recommended the construction of a viaduct on Louisiana St., the closing of Chicago St. and leaving Michigan St. at grade.

The principal criticism of the plan was that it destroyed terminal freight facilities, and as the passenger and local freight tracks of all the roads involved were so closely connected, it would be impossible to raise the passenger tracks and not the freight tracks, and obtain any relief. It had now become plain to those who had watched these matters up to this time that the railways would do nothing voluntarily, and that legislative enactment would be required, creating a commission for the purpose, clothed with power to adopt plans, make contracts and apportion cost whenever an agreement could not be reached between the city and the railways. In February, 1888, the following Board of Engineers was called together by a joint committee of the various bodies having the matter in hand, to prepare and submit a comprehensive plan for the general relief of the city from grade crossings, upon which report an Act was to be prepared to present to the Legislature for passage: John Bogart, then State Engineer of New York; the late A. M. Wellington, Editor of Engineering News; Geo. W. McNulty, expert Bridge Engineer; Walter Katte, Chief Engineer, N. Y. C. & H. R. R. R.; C. W. Buchholz, Chief Engineer, N. Y., L. E. & W. R. R.; Henry Flad, Chief of the Bureau of Public Works of St. Louis, George E. Mann, ex-City Engineer of Buffalo.

The plan of Mr. Spencer was submitted to the Board and fully explained by him, with maps, plans and estimates; also a plan offered by Mr. Buchholz, the principal feature of which was a Union Terminal Depot for passengers and local freight and the exchanges of properties of the railway companies to eliminate the crossings with each other. A great deal of matter had been prepared by the City Engineer for the use of the Board, such as maps, plans, surveys, etc., of existing conditions of railway and street crossings, together with map of topography of the city. With these data and examination of the various crossings, after several days' study, the Board submitted a report, which in brief was as follows:

> That the universal elevation of passenger and freight tracks was impracticable, because of the terminal facilities which would be curtailed, and in many cases destroyed, by such a plan, if carried out, affecting alike the individual patrons of the railways and the railways themselves. The practicability and advisability of constructing viaducts in the principal thoroughfares in the low part of the city, and the construction of subways when drainage could be had in the higher portion of the city, by partially raising the railway tracks and depression of the streets, were agreed upon. This, together with the Buchholz Union Terminal Depot scheme for passenger and local freight and the exchanging of properties of the different roads, was highly commended and approved.

Based upon this report an Act was passed May 22, 1888, entitled "An Act to provide for the relief of the city of Buffalo and to change and regulate the crossing and occupation of streets, avenues and public ground in said city by railways." Through the medium of a commission named in

the bill, provision was made for the City Engineer and the engineer of the railway with whom the city should make a contract, to prepare detail plans, which, after due approval and being duly signed, should be part of a contract.

Immediately following the passage of the Act the Commissioners met, organized and opened negotiations at once with the various railway companies, with a view of making contracts on the Board of Engineers' plans, and as provided in the Act of the Legislature.

The railway companies not being able to agree after strenuous efforts upon the Union Terminal feature of the plan, and as they could not be forced to adopt it, it was with regret eliminated from the plans, and all subsequent negotiations were made with each and every road separately.

The first contract was made with the Lehigh Valley R. R. Co., which had very little to do, as its tracks were already elevated, except at their terminus. Following this the Engineer of the New York Central & Hudson River R. R. and the City Engineer prepared plans of relief for that line and the West Shore, on which, on Oct. 11, 1889, a contract was executed between the two companies and the Commissioners. This plan followed the plan of the Board of Engineers, excepting the Union Terminal feature. Beginning at the westerly end of Erie St., on the Terrace, the tracks are to be depressed so as to admit of a tunnel 200 ft. in length at Main St., the tracks at Washington St. to be depressed to same level as at Main St. and the street carried over by a bridge, the depression of the tracks to continue through the passenger depot to east of Chicago St. At Michigan, Chicago, Louisiana, Hamburg and Seneca Sts. viaducts are to be built carrying the streets over the tracks. Easterly from Seneca St., for a distance of 1 1-6 miles, the tracks are to be raised an average of 7 ft., and the intervening streets depressed an equal amount, thereby providing subways under the tracks.

The plans of structures in all cases were narrower than the streets, with provision for taking strips of land along each side of the structures, up to the railway land, for the accommodation of the property owners on that part of the street. It also provided for a street parallel and adjacent to the N. Y. C. & H. R. R. R. tracks on the north side, to be known as North Railroad Ave., to provide a near outlet to the subways. A parallel street on the south side, South Railroad Ave., already existing, was to be used for a similar purpose. The estimated cost of the work, including the taking of lands under the contract, was $3,000,000.

In 1890 an amendment to the law of 1888 was passed in the state Legislature after bitter opposition from all the railways except the New York Central, West Shore, and Lehigh Valley companies. This Act gave extended powers to the Commissioners, with more "shalls" than "mays," its object being to reach the roads which would not enter into contract.

In the latter part of 1891 negotiations with the Delaware, Lackawanna & Western R. R. Co. had reached a point where plans were agreed upon and a contract drawn, but it was not signed until 1895. The plan provides for an elevation of their tracks from the Buffalo Creek R. R. connection to the Western New York & Pennsylvania R. R. crossing, an average height of 8 ft., thereby admitting of the passing of Seneca St., Elk St. and Abbott Road under their tracks by subways. The estimated cost of the work is $150,000.

Continued opposition of some of the railway companies to any plan suggested, or to doing anything in the way of getting the needed relief, necessitated further legislative enactment, and in 1892, under the insistance of the city's representatives at Albany, and with bitter opposition from the railways, a bill was passed giving much larger and arbitrary power to the Commissioners.

Opposition to the plans on which the N. Y. C. & H. R. R. R. Co.'s contract was based now appearing from the citizens and residents of the south and east side of the city (it was believed by the Commissioners to have been instituted by the opposing railways as a further means for delay and as a final resort), it was felt that new plans were called for and the whole subject matter was therefore reopened. According to the wishes of the Common Council the Grade Crossing Commissioners called in three engineers, Messrs. E. L. Corthell, of Chicago, Ill.; A. N. Locke, of North Adams, Mass., and Gen. Geo. S. Field, Chairman of the Board of Public Works, Buffalo, to examine the plans, review the entire question, and make a report. In November, 1892, Messrs. Corthell and Locke submitted a majority report, and General Field a minority report. The majority report advised the elevation of almost all the tracks in the city, both passenger and freight, with hydraulic lifts at the freight terminals. The estimated cost of the improvement was $10,450,000, exclusive of the cost of remodeling all of the local manufactories, machine shops, lumber yards, grain elevators, etc., now having track facilities, which at a conservative estimate would cost $5,000,000 to $6,000,000 more. This report entirely ignored the fact that the city had made a contract involving $3,000,000 with a railway company, the plan of which could not be changed without that company's consent or agreement. It reintroduced the old Union Terminal plan, which had been considered and dropped by the Commissioners long before.

General Field submitted a minority report, following closely the lines of the plan of the Board of Engineers and the contract with the New York Central & Hudson River R. R.

The plan finally adopted by the Commissioners, and upon which the work is now being carried out, was their own plan, prepared by their engineer, Mr. Geo. E. Mann, M. Am. Soc. C. E., now known as the plan of November, 1892.

The estimated cost of this plan was practically the same as for the old plan. Under it a new contract was prepared and has been executed with the New York Central & Hudson River and West Shore railway companies involving a cost to these companies of $3,000,000; a contract has been closed with the Delaware, Lackawanna & Western R. R. Co. amounting to $150,000; a contract with the Lake Shore & Michigan Southern R. R. Co. is ready for execution, the estimated cost being about $340,000; plans have been agreed upon with the Western New York & Pennsylvania R. R. Co., the cost being set at $425,000; and negotiations are favorably progressing with the New York, Lake Erie & Western and Buffalo Creek railways for contracts amounting to $900,000 and $125,000, respectively. According to this plan the railways agree to pay the entire cost of raising or depressing the tracks, and the entire cost of constructing subways or viaducts within the bounds of their property lines, and these lines extended across the streets; also two-thirds of the cost of lands required for widening the streets for use by vehicles, street railways and passenger traffic, and one-half of all proved damages to property injured. In addition to this the railways agree to pay two-thirds of the cost of construction of approaches to subways and viaducts, and one-half of all proved damages to adjoining property caused by such changes in the grades of the streets.

The essential features in which this plan differs from the plan of 1889 are in constructing the viaducts and subways the full width of streets, the taking of no land alongside of the structures, except on Michigan, Chicago and Louisiana Sts., and the raising of the New York Central and West Shore tracks an average of 7 ft. above the present elevation between Seneca and William Sts., by which means the approaches to the subways are materially shortened.

In the apportionment of cost between the railways which have not yet made contracts and the city of Buffalo is made on the same basis as that of the New York Central, West Shore and Lake Shore companies, the city will pay in the aggregate $750,000. Allowing additional sums for consequential damages, the entire expenditure by the city will not exceed $1,000,000, as against $5,000,000 by the railroad companies.

A contract has been made by the New York Central & Hudson River R. R. with Messrs. Dwyer & Huntington to do its part of the work on Michigan, Washington and Main Sts. and the Terrace, and the city has contracted with the same parties to do its part of the work, the aggregate amount of both contracts being $245,600.

The work consists of constructing a viaduct at Michigan St., a bridge at Washington St., a tunnel at Main St., and open cut with retaining walls through the Terrace.

The viaduct is to be of iron and steel truss spans with 42-ft. width of driveway on the trough floor system, asphalted, and two sidewalks of 7 ft. each in width. The bridge spans rest on pier masonry on pile and concrete foundations, piles driven to the rock. The approaches are to be of solid masonry up to a height of 13 ft., and paved with block stone pavement laid on a grade of 4% and the balance of approaches to be truss spans similar to the bridges over the tracks. The beam tunnel at Main St. will have a trough roof, covered with tinder and asphalt pavement.

The following gentlemen compose the Grade Crossing Commission: R. B. Adam, Chairman; John B. Weber, E. H. Butler, Geo. Sandrock, F. L. Kendall, H. D. Kirkover, A. F. Scheu, W. J. Morgan and Chas. A. Sweet. Mr. Geo. E. Mann is Engineer of the Commission, and Spencer Clinton, Esq., is the Attorney.

The streets crossed and the railways interested in the grade-crossing work are shown by the map, Fig. 1, which, together with the preceding discussion, have been furnished us by Mr. Geo. E. Mann. In the following paragraphs some of the special features of the work are described and illustrated in detail.

New York Central & Hudson River R. R. Improvement.

The foregoing outline of the grade-crossing problem in Buffalo will give a very clear understanding of the general features of the work to be done. Only one company—the New York Central & Hudson River R. R.—has yet begun work or prepared plans of the structures, and the more interesting features of these are illustrated herewith. Briefly described, there will be two classes of work—viz., viaduct construction and subway construction. Figs. 2 to 9 show the general character of the viaduct work, and Fig. 10 some features of one of the subways.

The viaducts selected for illustration are ones crossing Michigan St., Fig. 2, and Washington St., Fig. 7, the first showing some of the heavier work, and the second the nature of the single short-span crossings. Fig. 2 is the general elevation of the viaduct which is to carry Michigan St. over the railway tracks and the Hamburg Canal. The trusses are riveted and rest on masonry piers and abutments, with one exception, where a steel pier was necessitated by lack of room for masonry. None of the trusses has any unusual features in its design or make up, and we therefore omit the details. Fig. 3 shows the construction of the steel pier referred to above.

Fig. 4 shows the sidewalk and main floor construction. The troughs used are the Pennsylvania Steel Co.'s section, and they extend transversely across the bridge, spanning the space between trusses. The sidewalks are carried outside of the trusses by cantilever extensions of alternate floor beams. The distance c. to c. of trusses is 42 ft., and from out to out of sidewalks the width is 56 ft. To support the troughs at intermediate points between their ends, there are four lines of I-beam stringers carried by brackets on the floor beams. The stringers for the sidewalks are 8 × 3-in. yellow pine. The sidewalks are planked and the troughs are filled with a binder covered with gravel and an asphalt pavement. Fig. 5 shows the method of draining the bridge, and Fig. 6 gives the details of the corrugated iron fence between the roadway and sidewalks.

The viaducts at Washington St. consist of five plate girders, spaced as shown by the half cross-section and plan, Figs. 7 and 8. Fig. 9 shows details of the girder construction and connections for the floor. It will be noticed that the standard rectangular section of the New York Central & Hudson River R. R. is used here instead of the Pennsylvania Steel Co.'s section, and, in fact, this trough is used in preference to the one shown in Fig. 4 throughout nearly all the work. The arrangement of the binder and paving and other details of construction are clearly shown by the drawings.

Fig. 10 shows some details of the subway construction. The railway tracks pass under the street, and the subway consists merely of side walls spanned by a solid roof of rectangular troughs filled with binder and paved with asphalt.

As will be seen, the work of the New York Central & Hudson River R. R. described above consists mostly of small structures, and is of interest for showing details of practice rather than from the magnitude of the structures. The plans illustrated were all prepared by the Bridge Department of the railway company, under the direction of Mr. F. W. Wilson, Jun. Am. Soc. C. E., and Mr. Walter Katte, M. Am. Soc. C. E., Chief Engineer.

Work of Other Railways.

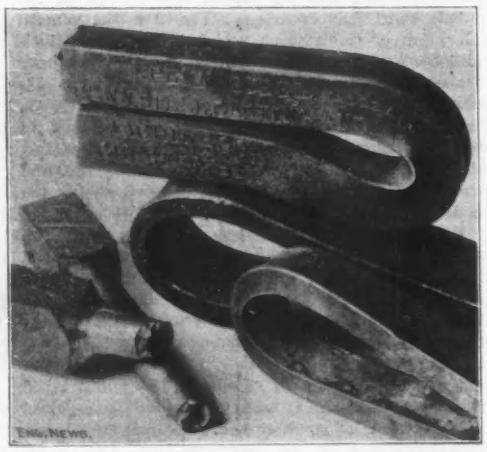
Of the other railways interested in the improvement of grade crossings, the New York, Lake Erie & Western R. R., and the Lake Shore & Michigan Southern R. R., will probably use the same system of construction that has been adopted by the New York Central & Hudson River R. R. and the Western New York & Pennsylvania R. R. As the city of Buffalo has to maintain the bridges, the railways feel disposed to conform closely to the wishes of the Commission; and since the plans illustrated are satisfactory to the Commission, nearly all of the railways will follow them in their general features.

The specifications for the Buffalo grade-crossing work were given in our issue of March 21, 1895, and in our issue of Jan. 31, 1895, was given a table showing the apportionment of expense between the city and the different railway companies.

TESTS OF TOUGH STEEL CASTINGS.

By Gus. C. Henning, M. Am. Soc. M. E.

Recent improvements in melting, casting and annealing steel have made its general use for castings in place of the ordinary product of the iron foundry so advantageous that a few results of recent tests may be of interest to engineers. The test pieces shown in the accompanying illustration were cut from coupons cast on the upper face of a suspension bridge anchor plate of the usual spider-shaped form. Six coupons were cast in each mold, but those nearest and farthest from the gate were selected for test purposes, as they would indicate the general character and uniformity of the steel



Test Specimens from Steel Castings.

better than those cast at other points of the upper surface of the castings. Coupons attached to the upper surfaces are, no doubt, inferior to the metal in vertical, or lower flanges, or webs, as they must contain all scoria, loose particles and gases, if there are any. The castings from which the coupons were taken were essentially six intersecting I-beams, with curved lower flanges, the vertical anchor bars passing through the box-like intersection at the center. The average thickness of webs and lower flanges was 1¼ ins., while box sides and top flanges were about 2 ins. thick. The depth of the casting was 32 ins., and the length of the longest arm about 14 ft.

The most remarkable features of the test pieces were the great ductility, fine grain, and perfect cup-shaped fracture, precisely like those obtained in tests of rolled steel. The bending tests were, in some cases, only carried out as required by the specifications, to an angle of 90°, but others shown in the accompanying cut were closed down under the press, to show what the material could do. The inner minimum radii were less than ¼ in. with thickness of piece of ½ in., while pieces 1 in. thick bent, as shown, to an inner radius of even less. The thick pieces do not show the slightest defect of any kind on the outside, nor is the usual transverse crack (cleavage) shown on the inside. It must be borne in mind that all of these castings were annealed before test coupons were separated from them. A large number of bending tests were made with equally good results, which showed that the steel was of remarkable uniformity.

Not only are heavy castings made to give such superior results, but the difficulties formerly experienced in making sound small castings appear to have been overcome. The surface of both large and small castings at the works where the above-described anchor plates were turned out (the Penn Steel Castings & Machine Co., of Chester, Pa.) is remarkably smooth and free from the pits, blowholes or honeycombing which formerly made the general use of steel castings very questionable.

As a consequence of the freedom from difficulties formerly experienced, steel castings are now being used for a much greater variety of articles than was the case a few years ago.

It is evident that when metal of such strength, toughness and uniformity can be secured in a casting, the designer of machinery who is aware of the fact can greatly improve his constructions, on the one hand, by substituting steel castings for cast iron pieces, and can reduce the cost, on the other hand, by using cast steel instead of forged steel for many parts.

A large part of the success obtained at the works above referred to is believed to be due to the method of annealing in use, by which initial strain and incipient cracks are wholly avoided. Failure in steel castings is often due to the shrinkage of the casting in cooling, which shrinkage is resisted by the sand in the mold, so that unequal strains are set up. To avoid this, the practice has been adopted of removing the sand from the interior of the flask as soon as the casting has set and before shrinkage has taken place. This is done by water jets. The flask is pierced with holes, and as soon as the casting is formed hose nozzles are introduced at these holes and the casting is washed out. The flask is then knocked apart and the casting is taken at once to the annealing oven, while it is still at or but little below a red heat.

The accompanying table gives the results of all the tensile tests made on the lot of castings above described, and with each pair of tests the chemical analysis is given. It should be said that these are all the tests made, none having been either selected or rejected. The tests can be safely accepted, therefore, as giving a fair idea of the quality of the metal.

Tests of Specimens Cut from Steel Castings.

No.	Area, sq. ins.	Yld. pt., lbs. per sq. in.	Tenacity, lbs. per sq. in.	Elong., % in 8 ins.	Reduc. of area, %	Remarks.
1.	.4441	32,500	63,050	24.1	51.0	Cup., fine silken gr.
2.	.4453	33,240	63,300	24.3	50.0	Ditto.
	C = .17	Si = .254	Mn = .48	P = .038	S = .033	Cu = 0.00
3.	.4429	29,120	65,480	19.1	27.6	Frc. c'rse, with flaws.
4.	.4406	27,460	65,840	13.1	38.2	Ditto.
	C = .18	Si = .27	Mn = .45	P = .04	S = .035	
5.	.4418	35,540	70,620	18.75	31.0	Slty. pitd.
6.	.4418	34,630	70,620	20.25	27.0	75% crys.
	C = .18	Si = .286	Mn = .53	P = .038	S = .035	
7.	.4465	38,500	75,200	17.5	27.9	Fine grn.
8.	.4417	37,300	73,800	20.8	25.3	Ditto.
	C = .20	.....	Mn = .59	P = .043		

PRESENT EUROPEAN PRACTICE IN REGARD TO SEWAGE DISPOSAL.*

By Allen Hazen.

There are two radically different sewage disposal problems. The first of these is the discharge of sewage into lakes or rivers, from which water is taken for domestic supply at points which may be reached by the discharged sewage. The problem in this case is to so completely purify the sewage that, when mixed with the water, it will not be injurious to health. Years ago, before the germ theory of disease was established, the possibility of purifying sewage in this way would hardly have been admitted, but, thanks to the more recent German and English investigations, as well as to the experiments of the Massachusetts State Board of Health, it is now well known that it is entirely possible to accomplish this through the wonderful purifying power of sandy soils, under proper conditions, and it is actually a fact that the effluents from certain European sewage works, as well as from some of the purification fields in Massachusetts, are preferable, from a hygienic standpoint, to the public water supplies of a number of large American cities.

The second problem in sewage purification is that of so purifying sewage that it will not cause a nuisance in the water into which it flows. When a small quantity of sewage is discharged into a large volume of pure, or comparatively pure water, the organic and polluting matters of the sewage are oxidized and destroyed by the oxygen of the air, which is ordinarily contained in solution in the water into which the sewage is discharged. In case, however, the quantity of sewage becomes greater than can be oxidized at once by this oxygen, the last part of the decomposition of the organic matters takes place in the absence of air, and with the formation of products, which are given off into the air, causing objectionable odors, and the whole body of the liquid becomes foul. The condition becomes still worse when the water is still, or has so low a velocity that it allows the heavier matters from the sewage to be deposited upon the bottom, where they accumulate as masses of mud, which decompose with the most objectionable results. This condition of affairs may often result, even though the quantity of sewage is not great enough to render the whole body of the water offensive, and is thus likely to occur in sluggish streams, which would otherwise remove the sewage without nuisance.

It is undoubtedly a fact that sewage has been purified much more frequently to prevent the production of a nuisance of this kind than to protect the purity of drinking-water supplies, perhaps because a black, dirty stream, giving off sulphuretted hydrogen gas, is more obviously a nuisance than is a polluted water supply, the relation of which to the health of the community is too often but imperfectly realized even by those having such matters in direct charge, and much less by the mass of voters and taxpayers whose support must be obtained before any expensive improvements are possible.

The processes which are used for purifying sewage may be divided into two general classes—land treatment and chemical—although a combination of both of them is frequently used.

One of the most interesting cases where sewage is purified to prevent the pollution of public water supplies, is furnished by the cities and towns upon the watersheds from which the water supply of London is drawn. Conservancy boards have control of the rivers, and it is their duty to see that they are not polluted so as to affect the quality of the water supplies drawn from them, or become otherwise injurious to the people upon their banks. The Conservancy Board of the River Thames has control of the main river for its whole length, and of its tributaries within 10 miles of the main river, measured in a straight line, but, curiously enough, it has no control of the tributaries beyond that distance. The conservators of the River Lea have control of the entire watershead.

There are 39 places upon these two rivers which are giving their sewage systematic treatment, and, so far as known, no crude sewage is ordinarily discharged into the rivers at any point. Of these 39 places, 38 treat their sewage by applying it to land, while one of the smaller places—Hertford—uses chemical precipitation. The conservators do not regard the chemical precipitation as satisfactory, and have recently conducted an expensive lawsuit against the local authorities to compel them to further treat their effluent. But this suit was lost, as the Court held that no actual injury to health had been shown. It is worth noticing, however, that the water into which the effluent is discharged, is all carefully filtered before it is delivered to consumers.

The conservators require, where land treatment is used, that sufficient area shall be provided to allow all of the sewage to percolate through it in ordinary weather, and they strongly object to allowing any sewage to flow over the surface of the land into the streams. The land used for this purpose is, as a rule, much less porous than the land commonly used for sewage treatment on Continental Europe and in this country, and at times of heavy storms there is often as much water from the rain alone as the land can take without becoming unduly flooded, and it is then incapable of receiving even the ordinary quantity of sewage, and much less the storm-flow, as the sewers are generally, if not always, on the combined system. At such times, the sewage either flows over the surface of the land, with the very inadequate purification due to the retention of solid matter in the grass and osiers, or perhaps more frequently it is discharged directly into the rivers, without even a pretence of treatment. The

* Slightly condensed from a paper read before the Boston Society of Civil Engineers, Oct. 16, 1895.

conservators apparently regard this as an unavoidable evil, and do not vigorously oppose it, it being their theory that at these times the increased dilution, with the high water in the rivers, is such that there is no great danger from the sewage, although it would seem that the increased velocity, and consequent reduction in time for the polluting matters to reach the water-works intakes, would, in a large measure, counterbalance the increased dilution.

The water companies are expected to have so much storage capacity for unfiltered water that they will not be obliged to take in water at times of flood. But, as a matter of fact, it is believed that they often do take in water at these times, although no records are kept either of the times when water is taken in, or of the times when the sewage is discharged without treatment. No evidence has been found that the health of the inhabitants of London is in any way affected by this discharge of sewage into the watercourse from which their water is drawn, but this favorable condition is believed to be largely due to the great care with which all of the water is filtered.

The cases of the other class where sewage is purified to prevent its becoming a nuisance, but without regard to possible pollutions of water supplies, are very numerous. Many years ago England took the lead in works of this nature, and has, at the present time, probably a larger number of works than are to be found in all the rest of the world.

England has a very dense population, but this is far from being equally distributed over its entire area. Near the southeast corner, or the tidal estuary of the Thames, is that enormous aggregate of population known as "Greater London," and in central England, directly back of England's greatest harbor, Liverpool, is a small area which has become perhaps the most densely populated of any region of its size on the face of the earth, due to the harbor and to the deposits of coal and iron ore which there occur. Within a distance of 40 miles from Manchester are Liverpool, Salford, Bolton, Preston, Oldham, Blackburn, Huddersfield, Birkenhead, Leeds and Sheffield, all of them great cities, and a hundred smaller places, which so completely fill the intervening spaces that parts of the region have almost the aspect of one great extended city. A large part of the area is a broken, hilly country, with steep, although not high, hillsides, between which are narrow valleys, in which are the railroads, mines and factories. The rivers, as they are called, are but short streams rising in the hills immediately back of the cities, and many of them would hardly be dignified with the name of river in this country.

With the great development of manufacturing, the sewage and wastes were at first discharged directly into the streams, until they became excessively foul, and the sewage problem was forced upon them in perhaps its most difficult form.

There were but limited areas of land in the valleys with elevations which would allow their use for sewage purification, and even these areas were often occupied by mills, or held at high prices in expectation of such use, and the land itself was, as a rule, compact, impervious and but poorly adapted to sewage purification. The conditions in this region were probably more favorable for chemical precipitation, as against land treatment, than at almost any other place, and chemical precipitation has been the most commonly used method of treatment, Leeds, Sheffield, Bradford, Manchester, Salford and Huddersfield, among the larger places, using it. Chemical precipitation, however, although great improvements have been made in the form of settling tanks and in the methods of managing them, removes scarcely more than one-half of the organic matters in the sewage, and never more than two-thirds, and the effluents generally carry on an average from 2 to 5 parts per 100,000 of suspended matters capable of forming deposits in the streams. It has been found that effluents purified to only this extent are very apt to produce more or less trouble when discharged into such small streams as exist in this region, and it is becoming more and more apparent that some more thorough process will be required before the problem can fairly be considered solved.

Already much has been done in this direction. At Sheffield, the effluent is taken through coke filters at a very high rate, and a portion of the suspended matters in the effluent is thus removed, although the purification obtained is far from what might be desired. This use of coke for filtering material has this strong point in its favor, that when the coke becomes dirty it can be burned with the matters accumulated in it under the boilers that are sure to be in use at the works. At Huddersfield the effluent is filtered through sand, and a patented substance called "Polarite," with the result that most of the suspended matters are removed, although the dissolved organic matters hardly have time to become oxidized with the rapid filtration employed.

At Bradford and at Salford experiments have been made on a considerable scale with rapid filtration through sand or coke, and forced aeration has also been experimented with, in the endeavor to find a process which is at once very rapid and capable of yielding effluents comparable in purity to those obtained from land treatments. This question of further purification for chemical precipitation effluents is now being everywhere discussed, and experimental filters are to be found with a surprising frequency, and we may confidently expect that the coming years will witness great changes in the methods of sewage treatment in this locality.

A little to the south of the Manchester district is Birmingham, a great manufacturing city, which treats its sewage first by chemical precipitation and afterwards applies the effluent to a large area of meadow land on both sides of the small river into which it eventually finds its way. Leicester, a few miles to the east, uses substantially the same process.

At London the sewers from a large metropolitan district have gradually combined into one great system, or rather two systems, one for the north and one for the south side of the River Thames, both of which are administered by the London County Council. The conditions here are in many respects different from those of almost any other large city. The sewage is carried down by intercepting sewers for some miles below the city and is discharged into the estuary, where there are very powerful tidal currents, in addition to the natural flow of fresh water from the river. Formerly the sewage was discharged without treatment at these points, but it caused so great a nuisance in the river, both to the shipping and to the residents upon the banks of the river, both below and above the points of discharge, that in recent years works have been built to treat the whole of it by chemical precipitation, except the storm overflows.

Although London is noted for its rainy weather, it seldom rains hard there, and the precipitation is more apt to come in the form of a slow drizzle, which the sewers are capable of removing, and the sewage which goes to the river through the overflows is much less than would be the case in an American climate. Mr. Santo Crimp, formerly in charge of the London sewerage works, has estimated that in the aggregate only about 4% of the sewage is discharged untreated into the river, the remaining 96% being treated before its discharge.

In Continental Europe the conditions for land treatment are, as a rule, more favorable than is the case in England, and chemical precipitation has gained but a slight foothold, only one large city, Frankfort, in Germany, employing it, although it is used at a considerable number of smaller places, and is being considered at Leipsic.

In the early days of chemical precipitation, lime was commonly employed as a percipitant, and where the sewage contains a large amount of iron and acid from wire works, as is the case at Leeds, Sheffield and Birmingham, lime answers as well or better than any other precipitant, but in other cases it has little to recommend it, and has usually been superseded either by copperas or by sulphate of alumina, although it is necessary to use with each of them a small quantity of lime to insure rapid precipitation. At London copperas is employed, while other English cities have varied their precipitants from time to time.

One of the serious problems connected with chemical precipitation of sewage is the disposal of sludge, and in selecting the precipitant it is necessary to consider not only the purity of the effluent which can be obtained, but also the quality and character of the sludge produced by it. At London several tank ships are employed which carry the sludge out to sea, each ship making two trips daily and carrying about 1,000 tons, of which 90% is moisture. To reduce the sludge to as small a volume as possible, it is pumped from the settling tanks into another set of smaller tanks and is settled over again, reducing it to one-third of its original volume. From these the supernatant liquid flows back into the incoming sewage to be treated over again, and the remaining sludge is run into the tank ships. These ships are of steel, and have air-chambers in their bottoms to give them sufficient buoyancy, so that the sludge will flow out through the openings in their bottoms when they reach the point of discharge, 50 miles from the works.

At Birmingham the sludge is run upon and dug into several hundred acres of land with fairly good results. At Sheffield and other places it is simply piled up on unused land and given away for a fertilizer when possible, and by sprinkling it with lime and with chloride of lime in summer it does not become an unbearable nuisance, although this practice can hardly be recommended. Manchester and Salford have hoped to carry their sewage out to sea, as is done at London, by means of the Manchester ship canal, but I do not know that they have yet commenced to do so.

Huddersfield and many of the newer works press the sludge in filter presses to solid cakes, which can be easily handled and which can be applied to land or stored without creating a nuisance. The putrefaction, which makes sewage and sludge offensive, seems to require the presence of an excess of moisture, and when the moisture is absent, as in pressed sludge and in land used for sewage treatment, this putrefaction does not occur, but the changes which take place are of an inoffensive nature. The cost of pressing is considerable, and it is this which probably prevents its being more generally adopted.

The shape of the settling tanks for chemical precipitation has been changed somewhat in the course of years. The earlier tanks were nearly square, and were often used intermittently, being filled with sewage, allowed to stand and afterwards emptied and then filled up again. This was known as the intermittent process, and has been almost everywhere abandoned, although it is still in use at Sheffield. In the continuous process, now generally used, the tanks are connected with each other and the treated sewage is run into a series of them, passing from one to another, until finally it is discharged. The newer works, however, as a rule, consist of long, narrow tanks so arranged that a portion of the treated sewage passes through each of them and is then discharged, so that each tank is entirely independent of the others. There is usually a sludge channel in the middle, a foot lower than the bottom, to insure a rapid removal of the sludge when the tanks are cleaned. All of the earlier tanks were open to the sky, but in 1884 Lindley built precipitation tanks at Frankfort covered with a vaulting with soil above, laid out as a garden. This arrangement prevents any possible interference with the sedimentation by the wind or by ice, and also makes a much more attractive-appearing place than the open tanks. The settling tanks at London are also vaulted. On the north side of the river the tanks are only 32 ft. wide, and there is a spandrel wall on arches halfway between them, and the roof is made of two continuous arches covered with earth, with manholes to furnish light. It is stated that it was quite as cheap to build the tanks in this way as it would have been to build them open, because the walls between the tanks, being supported at the top, are very much thinner than would have been necessary with open tanks, and the excavated material was placed above the vaulting without expense for removing it, and the economies thus affected fully equaled the cost of the vaulting. The more recently constructed settling tanks on the south side of the river are of the same general construction, but the manholes were omitted, and it is found that there is both a great saving in the cost of construction and the work that requires to be done in the tanks can be better done by artificial light than by the very poor light admitted through the manholes.

Vertical settling tanks like those used at the World's Columbian Exposition at Chicago are occasionally used in Germany, particularly in small places, and are in some respects convenient, although the sedimentation is probably less complete than is the case with properly constructed horizontal tanks. The famous tanks at Dortmund are being replaced by broad irrigation.

In other parts of England, where the population is much less dense than in the districts mentioned, and where land for sewage treatment is more easily secured, chemical precipitation works are the exception rather than the rule, and sewage farming is generally employed where sewage requires to be treated.

On the continent, Paris adopted land treatment for sewage many years ago, but selected an area quite near the city, and which was only large enough to receive a portion of her sewage. The process was entirely satisfactory as far as purification was concerned. No nuisance was created, and some return on the capital invested was obtained from the crops. There was, however, no land suitable and convenient for treating the remainder of the sewage without going some miles further down the river, and for many years the system was not extended.*

In the '70's Berlin took the matter up and adopted substantially the same system which was then in use at Paris, and has since extended it from time to time until, for many years, all of the sewage of Berlin has been treated. Berlin, with its immediate suburbs, has, at the present time, a population of nearly two millions, and is growing almost as fast as Chicago, but the population is very compact, and the surrounding country for many miles consists of sandy land in every way suitable for sewage treatment, but too poor to repay ordinary cultivation. Under these circumstances, there has been no object in economizing in the area of land used, and the city has taken large areas of land and is extending the mains to irrigate as large an area as possible with sewage. In 1893, 10,800 acres were in use, receiving on an average 4,100 gallons per acre daily. The sewage is all pumped and treated, except when, in thunder-storms, more rain falls than can be carried by the sewers. The Spree, flowing through the heart of the city, is said to have been as dirty as the Chicago River is at the present time before the

* For an extended description of the improvements to the Paris sewerage system, including new sewage farms, see Eng. News, Aug. 22, 1895.—Ed.

works were commenced, but it has been so thoroughly cleansed that one would hardly suspect it of having once been polluted by sewage. The irrigated land is cultivated with some profit to the city, and in good years 2% net profit of the capital of about $6,000,000 has been earned. After Berlin adopted land treatment for her sewage, Dantzic and Breslau introduced substantially the same process, and more recently Magdeburg has been preparing land to be used in the same way, while Cologne, Hanover and other cities are talking of doing so.

The German cities, as a rule, are situated upon much larger rivers than are the English cities, and sewage disposal has not been so pressing a problem with them, but, on the other hand, the conditions for disposing of the sewage upon land are much more favorable than in England, and the expense of carrying out the process is less, and now that the process has been demonstrated by many years' trial in the three cities mentioned to be a practical success, the Imperial Board of Health, which has great power in these matters, is insisting upon the adoption of sewage purification in almost all cases where important extensions or changes in the sewerage systems are made.

The soils used for sewage purification in Germany are invariably sandy, pervious materials, and the natural surface of the ground is so nearly level that it can be developed with a minimum of expense. The areas are usually divided into separate beds by low earth embankments, quite similar to those at Framingham and Marlborough, Mass. The surface of these beds is always cultivated, grass, beets, cabbages, wheat, rye, oats and apples being the most common crops. Wheat and oats when they are irrigated grow very rankly, and, as the farmers say, run to straw, and good crops are seldom obtained. Our American corn or maize cannot be successfully grown, because the summers, and particularly the summer nights, are not warm enough, and the grain will not ripen.

Germany is some degrees farther north than New England, and the winters are of about the same severity, but the winter nights are much longer and the days shorter, and it thus happens that in the darker months of the year it is impossible to distribute all, or even the greater part, of the sewage over the land by daylight, and it is found that however carefully the instructions are given, the men having the distribution in charge will not properly perform their work at night. To provide for this contingency, certain areas are set apart upon all the German farms having substantially level surfaces and surrounded by embankments much higher than the ordinary embankments—that is, 8 or 10 ft. high. The areas are also much greater, often containing 10 or 20 acres in one lot. During the long, dark nights of the fall and winter sewage is run into these basins, often filling them several feet deep. Of course, little purification takes place under these circumstances, but, owing to the cold weather, the sewage is retained pretty nearly in its original condition, or at least without offensive decompositions, generally covered with an ice sheet during the winter.

As soon as the days become longer, in early spring, all of the sewage is again applied to the land, and these basins are no longer used. The ice melts and the pond of sewage soaks away in the course of a few weeks, and the surface of the land, covered with the organic matters which have been strained from the sewage, is exposed to the air and becomes dried, and soon afterwards it is plowed under and the matters are destroyed, as in the ordinary process of intermittent filtration. Wheat and oats can be raised in these basins in the summer, and good crops are obtained. No sewage is ever put upon them except in winter.

At Paris, as in the English sewage farms, the embankments between the beds are a much less conspicuous feature, and one of the most common methods of applying sewage is to have the land in ridges and furrows, the sewage being turned into the furrows, while vegetables and other crops are raised upon the ridges, which are never covered by the sewage. Of course, it is necessary at certain points to have embankments to prevent the sewage from running over the surface into the river, but these are reduced to a minimum.

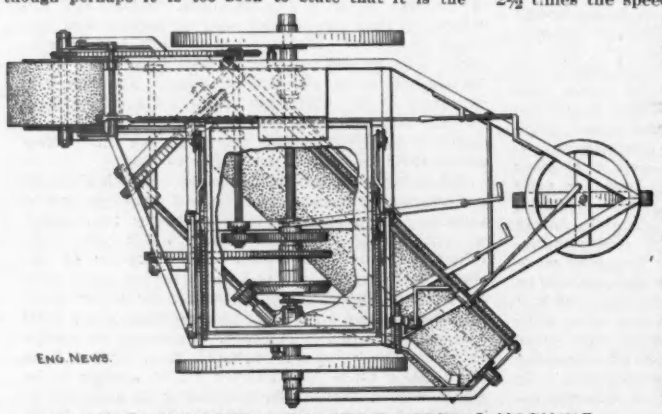
There are some unusually interesting sewage disposal problems in some of the Dutch cities. Amsterdam and The Hague are situated upon the intricate system of canals which intersects a large part of Holland. Streets, as a rule, are 3 or 4 ft. higher than the water in the canals, and the houses are built upon foundations about even with the streets, and there are no cellars. There is usually a canal between every two streets, and in the few cases where it is omitted, it is in any case but a short distance from any part of the city to a canal. It has been the custom ever since the memory of man to discharge all sewage, garbage and other waste into the canals direct. This has resulted in the canals becoming extremely foul and sources of much complaint.

The conditions have been somewhat improved by constructing considerable reservoirs, which, regulated by means of gates and used in connection with the tides, allow considerable currents to be maintained in most of the canals, and in this way the conditions have been maintained without becoming excessively bad. The limits of this system of flushing have, however, been nearly reached, and it is apparent that some further treatment will be required. Several of the leading Dutch engineers are exerting their ingenuity to see how a series of sewers can be constructed for The Hague, but the problems of ground water, canal crossings and pumping stations are really very serious.

In Amsterdam a portion of the central part of the city has been for some years sewered on the Liernur system. This system was much talked about some years ago, and was thought by many to afford a solution to the sewerage problem. It consists of a system of iron pipes, in which a partial vacuum is maintained, and into which sewage matters are passed without water, and the material is drawn in a concentrated form to a pumping station, where it is distilled with lime, giving off ammonia, which is condensed in acid to form an ammonium salt, which is sold, and the residue is dried and compressed into cakes, which have some value as a fertilizer.

At the present time about 62,000 people are connected with this system in Amsterdam, and about six tons of ammonium sulphate are produced per week, which partially pays for the cost of operation. The system is being slowly extended to other parts of the city, although perhaps it is too soon to state that it is the definitely adopted plan of the city, and developments may be awaited. This is altogether the largest plant upon the Liernur system, and possesses very great interest to those only familiar with the water-carried system of sewerage.

In conclusion, the trend of the best European practice in sewage disposal is strongly toward the treatment or purification of sewage in all cases before it is discharged into rivers, with the exception of very large rivers, and at points where there are strong tidal currents. The tendency is to use land treatment wherever the local conditions are reasonably favorable, as the effluents produced in this way are of much greater purity than can be obtained by any chemical or mechanical processes, and the cost is ordinarily less. Where the local conditions are such as to preclude the employment of land treatment, chemical precipitation is used, but although material improvements have been introduced in the construction of the settling tanks and in the methods of applying chemicals, it is not possible to produce effluents of sufficient purity to be discharged into the smaller rivers without creating more or less complaint, and the tendency is strongly to follow chemical precipitation in such cases by a rapid filtration through some material which will remove substantially all of the remaining suspended matters, and will allow, at least, a portion of the soluble organic matters to become oxidized.



PLAN OF UNIVERSAL STREET SWEEPING MACHINE.

THE UNIVERSAL STREET SWEEPING MACHINE.

Street-sweeping machines of the "pick-up" type, which will efficiently sweep up and remove street dirt and refuse, are much to be desired as part of the sanitary equipment of cities, but, as we have remarked in a previous issue, they can only be expected to work satisfactorily on reasonably good pavements, and not where ruts and holes and rough surfaces prevail.

UNIVERSAL STREET SWEEPING MACHINE, WITH APPARATUS FOR REMOVING SWEEPINGS.

We illustrate this week the Universal street sweeping machine, which belongs to the type above mentioned and has been tried with success in New York and other cities. It consists of a strong iron frame carrying a 26-in. diagonal revolving broom, which sweeps the dirt into a windrow. Directly in line with this windrow, and behind the delivering end of the long broom, is a short broom 31 ins. diameter and 2 ft. wide, which revolves at 2½ times the speed of the main broom, and drives the material of the windrow into a chamber at the base of an endless belt elevator, the buckets of which carry up the dirt and dump it into a chute through which it falls into a covered bin mounted on the frame of the machine. This bin is carried by trunnion bearings at each end, and when full a dump cart is driven alongside the machine and the bin is tilted by means of a crank handle and gearing to discharge its load into the cart. The machine weighs about 4,000 lbs., and is drawn by three horses at a steady walking pace. Fig. 1 is a general view of the machine, and Fig. 2 is a general plan, showing the gearing.

Dirt, manure, waste paper and general refuse are readily removed, and it is claimed that even stray bricks, etc., can be handled; but as a matter of fact, such heavy articles will cause the rear broom (which is balanced) to lift and pass over them. This, however, is not to the discredit of the machine, as a street-sweeping machine is not intended to handle building material. As the large gang of men usually required for sweeping up the windrows and shoveling the dirt into the carts is thus dispensed with, it would be well to have one man walking with the machine to pick up and throw into the bin any large or bulky articles which the broom might pass over or sweep into the gutter without picking up. This was remarked during an inspection of the work done in this city by a member of the staff of this journal. An old broom, some bricks, large pieces of paper, etc., were either

passed over or were left in deep holes in the gutter, which the broom could not reach.

Two of these machines were tried under the direction of the New York Street Cleaning Department, the machines following one another and making three trips through each street, going up one side, down the other side, and then back along the middle of the street. The street is watered directly before sweeping, as otherwise the brooms raise an intolerable cloud of dust. The street surface was clean and of good appearance. The damp material causes little dust, so that the canvas cover of the bin is not always required, and the material packs hard in the bin, and has to be raked and shoveled out into the cart. The capacity of the bin need not be much more than 1 cu. yd., which is the capacity of the ordinary dump cart. If worked steadily, without delays caused by waiting for the water carts to replenish their supplies, the machines can sweep about a mile of street an hour.

Four of these machines were ordered by the Street Department of Boston, Mass., after Mr. H. H. Carter, M. Am. Soc. C. E., Superintendent of Streets, had made a personal investigation of the working of the machines. Mr. Carter stated in a letter to the builders in December, 1894, that the machine had demonstrated its ability to do the work at about 45% of the cost under the former method, by which the dirt was swept into windrows by ordinary horse side-sweeping machines, then swept by hand into piles and shoveled into dump carts. No line of dirt was left behind the machine. The actual work on which the above comparison was made was as follows: A gang of 33 men in connection with two one-horse and two two-horse sweeping machines and nine one-horse carts, swept up and carried to the dump in three hours nine loads of dirt, with 24 cu. ft. to the load. The pick-up machine, with two men and one horse and cart, swept up and carried to the dump (with same length of haul) in three hours, four loads of material. If the machine was used in the immediate vicinity of a dumping place, the use of the horse, driver and cart could be dispensed with, thus effecting a further reduction.

The machine was invented by William M. Tobey, of Boston, and a patent was issued to him, Sept. 11, 1894, the first machine having already been tried in Boston during the summer of that year. The machine is manufactured by the Universal Street Sweeping Machine Co., of Boston, Mass., and we are indebted to Messrs. Frank A. Dearborn, General Manager, and George W. Sias, Superintendent, for information concerning it.

MANAGEMENT AND HANDLING OF RAILWAY MOTIVE POWER.*

1. Adaptation of Locomotives to the Particular Requirements of the Traffic to Produce the Most Economical Results.—Locomotives should be selected with particular reference to the work they are expected to do, and should be confined as closely as possible to that work. If the average passenger service requires a train of seven cars to be run at a speed of 40 miles per hour, locomotives should be selected to meet those requirements; and after having been so selected, they should not be expected to show economical service with trains much heavier or much lighter, or run at very different speeds. The same considerations should govern the selection of locomotives for freight service. Locomotives for fast freight service and locomotives for slow freight service should be selected, and neither one should be expected to show economical performance if put to the work of the other.

As a general condition, the superintendent is not sufficiently familiar with his engines to know what their most economical performance may be, nor has he a sufficient feeling of responsibility for the economical performance of his engines. He depends too much on the mechanical officers, trusting to them to furnish engines which will do the work, and then using them as the exigencies of the service seem to require. On this point there should be a better understanding than there generally is between superintendents and their mechanical officers. The superintendent should say what he requires of his locomotives, and he should then be furnished with locomotives to fill those requirements, after which he should feel himself responsible for their economical performance.

*Abstract of the report of the committee on "Machinery" presented at the annual meeting of the American Society of Railroad Superintendents, held in New York city, Oct. 14, 1895.

2. Economical Loading of Locomotives.—After being supplied with locomotives designed to fill requirements as he has laid them down, it goes without saying that the superintendent should see that such locomotives are at all times properly loaded. Experience has so far demonstrated that loading engines on a tonnage basis gives the most economical results. On the Pennsylvania lines, the tonnage system of rating is giving very satisfactory results, one of the divisions showing a saving in train mileage of about one-seventh since it was adopted. On the Columbus, Hocking Valley & Toledo R. R., the saving in 1892 was 17%, the average tons per train having been increased from 506 to 593. On the Union Pacific Ry., also, where the tonnage system has been tried, it is reported that engines make a better uniform time with a larger average tonnage than formerly, and that the plan has resulted in an increase in train haul of nearly two cars per train. In adopting the tonnage system, the first thing is to establish the capacity of your engines; the next thing is to establish a method for computing loads. Knowing the dimensions, it is an easy matter to establish theoretically the maximum hauling power of a locomotive, but the figures thus reached are not always supported in practical service. There is frequent disappointment in the actual power developed, for what may be the capacity of a locomotive to-day may be either more or less than its capacity to-morrow or the next day. A locomotive should not be expected to develop as much hauling capacity in severe winter weather as in summer. The condition of cars, brasses and journals is also a factor to be considered. The superintendent cannot profitably say to his yardmaster or trainmaster, "The capacity of such an engine is so many tons, and it must invariably be loaded up to its capacity." The maximum capacity under favorable conditions should be known, and then sufficient latitude should be permitted for reasonable deductions from such maximum in consideration of unfavorable conditions, care being taken to see that good judgment is exercised in making such deductions.

3. Economy in the Use of Fuel and Supplies.—This is a matter which depends to a great extent on the training and intelligence of employees: It is necessary that they should be trained to a thorough knowledge of economical methods, and furnished with proper incentives to always apply such methods. Much may be accomplished by stimulating a spirit of rivalry among employees as to who can make the best record, and establishing some system of rewards in recognition of such records. Some very satisfactory results in economical coal consumption have been attained on the Pennsylvania lines by means of a system which seems very generally applicable. An allowance is made which is considered ample for the performance of a locomotive in a specified service. The coal thus allowed is charged to the company at a certain figure, say, $1 per ton, and on each ton saved from the allowance the fireman is credited with 25 cts., the engineman with 25 cts., and the company with 50 cts. During the month of July the total premium paid to employees on one division was $1,950, the company, of course, being credited with a like amount. One crew earned $15.50 premium on coal in this month. This method could be adopted in the use of oil and waste. A very similar method is used by the Fall Brook R. R. in the use of oil, the only difference being that the oil is charged to the engineman, instead of the company, and there are no cash premiums paid for amounts saved. Enginemen are allowed to use 30 cts. worth of lubricating oil for 100 miles run with engines having four drivers coupled, 35 cts. for six-wheel, coupled engines, and 40 cts. for consolidation engines. The report for the first eleven months of 1893 shows that some of the men exceeded their allowance, while others used much less. The general average shows that the men who used more oil than they should, drew $243.28 worth over their allowance, while the men who used less saved the company $954.18, thus leaving a balance to the credit of the company of $710.90. By merely exercising careful supervision over the methods of handling oil, and without any system of rewards for economy, the Flint & Pere Marquette R. R. is able to show the following results:

	1893.	1894.	1895 (8 months).
Loco. mileage per pint of oil.....	21.27	30.34	35.17
Cost per 1,000 loco.-miles run....	$2.18	$1.144	$1.121
Freight car-miles per pint of oil..	138.32	164.66	207.74
Passenger car-miles per pint of oil	78.82	93.79	98.94

4. Track and Yard Facilities for the Proper Handling of Traffic.—Much depends upon the proper arrangement of sidings. They should be ample in number and extent, and properly distributed with reference to the ordinary movement of trains to enable them to get over the road with as little side-tracking as possible. On single-track roads the lap siding is recommended as a very economical arrangement, as it obviates all necessity for backing out, and enables trains to pass each other with the least delay and minimum use of coal. Yard facilities should be ample to permit the free and unobstructed movement of trains in transit. There is no economy in rushing trains over a division, only to hold them uselessly until all the advantage of prompt movement is destroyed because of improper yard facilities at its end. There are many yards where all necessary switching might be done with several crews less than are actually used, if the yards could only be arranged properly. Work of the different crews should not conflict. Switching work should be done as far as possible by switching engines, not only because road engines, not being generally adapted for such work, are unable to do switching with the highest economy, but also to avoid charges for detention time, and delay to prompt movement of motive power.

5. How to Obtain the Maximum Service from a Locomotive during the Whole Extent of its Life.—True economy demands that a locomotive should exhibit its maximum service, and be worked to the limit of its full earning capacity throughout its entire life. It is not possible, of course, to arrive at this perfect requirement of economical service, but an effort should be made to approximate it as closely as possible. The first condition to such approximation is shops of sufficient capacity to meet all demands which may be made upon them for repairs, equipped with such modern tools and machinery as will enable work to be done with the highest economy. When this condition is satisfied, in many cases there should be a shifting of the standards of economy. The first consideration with many officers is to keep a locomotive out of the shop as long as possible; in other words, to make them show the greatest possible number of miles run between shopping. This is one standard of economy, and much energy is devoted to that end, regardless of whether engines are performing economical service for the company, and regardless of track, roadbed and structures. Mileage thus attained, during which time locomotives have actually been losing money for the company, is entered as one of the factors of economy. It is needless to point out that the real interests of the company are thus frequently sacrificed in the effort to maintain a false standard of economy. It is, of course, desirable to have engines show as large a mileage between shoppings as possible, but the other highly important factors of economy should not be sacrificed to this end; and this end should be conceived only within the limits of economical mileage. The factors of economy in all departments must harmonize and correspond in order that the best interests of the company may be served; they cannot conflict with each other.

STUART'S VENTILATED MANHOLE AND DUST PAN.

A perforated manhole cover, with dust pan attached, is illustrated herewith. This cover is designed to perform the usual services in the way of ventilation. Its principal claims of novelty or credit

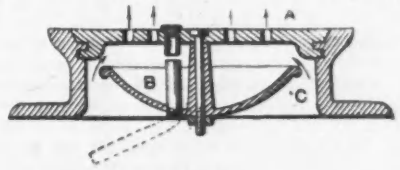


Fig. 1.

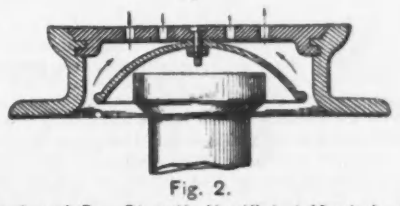


Fig. 2.

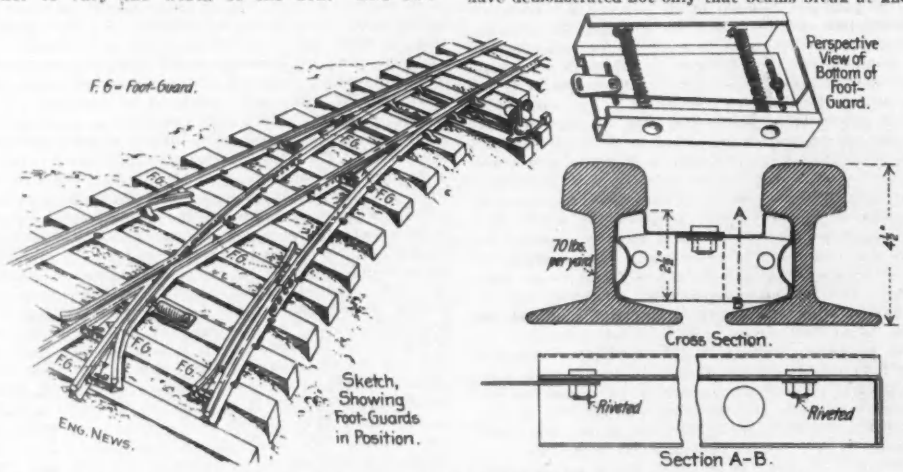
Figs. 1 and 2. Stuart's Ventilated Manhole and Dust Pan

are the form of the dust pan, and the provision for draining the same, all as shown in Fig. 1. For combination lamp-holes or flushing holes and ventilators the form of cover shown by Fig. 2 has been devised. In this form, the manufacturers state, sufficient space is provided below the cover for a year's accumulation of dust and dirt. The devices described are made by the Co-operative Foundry, of Detroit, Mich., and were invented by Mr. Johnston Stuart, Manager of that concern, to whom we are indebted for the above information.

THE NATIONAL FOOTGUARD FOR FROGS, SWITCHES AND GUARD RAILS.

A large number of accidents to railway employees are caused every year by men getting their feet caught in the space between a track rail and guard rail or between the rails of a switch or frog, the men being unable to free themselves, and being run over and either killed or maimed. Such accidents are especially common in yards. Dif-

ferent forms of footguards are used to fill this space and prevent such accidents, the commonest form being wooden blocks cut to fill the space; but these are by no means universal, although some states have passed legislation compelling the railways to equip their track with devices of this kind. We illustrate this week a metal footguard which has been tried with satisfactory results on a number of roads, and which has the special feature of being compressible, so that it can be used for split switches and spring rail frogs. The guard resembles a box open at the bottom and at one end, being made of two pieces of sheet steel and so shaped that the sides can be pressed together to vary the width of the box. The two



NATIONAL FOOT-GUARD FOR SWITCHES, FROGS AND GUARD RAILS.

pieces are pressed apart by spiral springs and are held together by two bolts fitting into transverse slots. The guards are made in various sizes, 4 to 42 ins. long, to fit any angle and any size of rail. They fit closely to the rails, do not interfere with the flangeways, and in split switches or spring rail frogs they expand and contract in conformity with the movement of the rails. When being put in place the sides are pressed together to allow the guard to be slipped in between the webs of the rails, and when released the springs force the sides into closer contact with the rails; a spike or rail brace at the back of the guard prevents it from working out of place. The cost ranges from 17 cts. each for 4-in. guards for 60 and 70-lb. rails, to 51 cts. each for 42-in. guards for 85-lb. rails. The guard has been patented by Mr. M. Riley, of London, O., and is manufactured by the National Railway Foot-Guard Co., of Columbus, O.

STRENGTH OF BRIDGE AND TRESTLE TIMBERS.

At the convention of the Association of Railway Superintendents of Bridges and Buildings, held in New Orleans last week, Mr. Walter G. Berg, Superintendent of Bridges and Buildings, Lehigh Valley R. R., as chairman of the committee appointed to report on the strength of bridge and trestle timber, gave a very interesting summary of the numerous tests of American timbers made during the last few years in respect to their comparative value for constructing trestles and bridges. The main features of this report are presented herewith.

The results of tests available and the opinions of the leading authorities on the strength of timber indicate the correctness of the following conclusions:

(1) Of all structural materials used for bridges and trestles, timber is the most variable as to the properties and strength of different pieces classed as belonging to the same species. Hence it is impossible to establish close and reliable limits of strength for each species.

(2) The various names applied to one and the same species in different parts of the country lead to great confusion in classifying or applying results of tests.

(3) Variations in strength are generally directly proportional to the density or weight of timber.

(4) As a rule, a reduction of moisture is accompanied by an increase in strength; in other words, seasoned lumber is stronger than green lumber.

(5) Structures should be, in general, designed for the strength of green or moderately seasoned lumber of average quality and not for a high-grade of well-seasoned material.

(6) Age or use does not destroy the strength of timber, unless decay or season-checking takes place.

(7) Timber, unlike materials of a more homogeneous nature, as iron and steel, has no well-defined limit of elasticity. As a rule, it can be strained very near to the breaking point without serious injury, which accounts for the continuous use of many timber structures with the materials strained far beyond the usually accepted safe limits. On the other hand, sudden and frequently inexplicable failures of individual sticks at very low limits are liable to occur.

(8) Knots, even when sound and tight, are one of the most objectionable features of timber, both for beams and struts. The full-size tests of every experimenter have demonstrated not only that beams break at knots, but that invariably timber struts will fail at a knot, or owing to the proximity of a knot, by reducing the effective area of the stick and causing curly and cross-grained fibers, thus exploding the old view that sound and tight knots are not detrimental to timber in compression.

(9) Excepting in top logs of a tree or very small and young timber, the heart-wood is, as a rule, not as strong as the material farther away from the heart. This becomes more generally apparent in practice in large sticks with considerable heart-wood cut from old trees in which the heart has begun to decay or been wind-shaken. Beams cut from such material frequently season-check along the middle of the beam and fail by longitudinal shearing.

(10) Top logs are not as strong as butt-logs, provided the later have sound timber.

(11) The results of compression tests are more uniform and vary less for one species of timber than any other kind of test; hence, if only one kind of test can be made, it would seem that a compressive test will furnish the most reliable comparative results.

(12) Long timber columns generally fail by lateral deflection or "buckling" when the length exceeds 20 times the least cross-sectional dimension of the stick. In practice the unit stress for all columns over 15 diameters should be reduced in accordance with the various rules and formulas established for long columns.

(13) Uneven end-bearings and eccentric loading of columns produce more serious disturbances than is usually assumed.

(14) The tests of full-size long compound columns, composed of several sticks bolted and fastened together at intervals, show essentially the same ultimate unit resistance for the compound column as each component stick would have if considered as a column by itself.

(15) More attention should be given in practice to the proper proportioning of bearing areas; in other words, the compressive bearing resistance of timber with and across the grain, especially the latter, owing to the tendency of an excessive crushing stress across the grain to indent the timber, thereby destroying the fiber and increasing the liability to speedy decay, especially when exposed to the weather and the continual working produced by moving loads.

In addition to the ultimate breaking unit stress, the designer of a timber structure has to establish the safe allowable unit stress for the species of timber to be used. This will vary for each particular class of structures and for individual conditions. The selection of the proper "factor of safety" is largely a question of personal judgment and experience, and offers the best opportunity for the display of analytical and practical ability on the part of the designer. It is difficult to give specific rules. The following are some of the controlling questions to be considered:

The class of structure, whether temporay or permanent, and the nature of the loading, whether dead or live. If live, then whether the application of the load is accompanied by severe dynamic shocks and pounding of the structure. Whether the assumed loading for calculations is the absolute maximum rarely to be applied in practice or a possibility that may frequently take place. Prolonged heavy, steady loading and also alternate tensile and compressive stresses in the same piece will call for lower averages. Information as to whether the assumed breaking stresses are based on full-size or small-size tests or only on interpolated values, averaged from tests of similar species of timber, is valuable in order to attribute the proper degree of importance to recommend average values. The class of timber to be used and its condition and quality. Finally, the particular kind of strain to which the stick is to be subjected, and its position in the structure with regard to its importance and the possible damage that might be caused by its failure.

In order to present something definite on this subject, your committee presents the accompanying table, showing the average safe allowable working unit stresses for the principal bridge and trestle timbers, prepared to meet the average conditions existing in railway timber structures.

Table Showing Average Safe Allowable Working Unit Stresses. Recommended by the Committee on Strength of Bridges and Trestle Timbers, appointed by the Association of Railway Superintendents of Bridges and Buildings.

Kind of Timber.	—Tension.— Lbs. per sq. in. With grain.	Across grain.	—Compression.— Lbs. per sq. in. With grain. End bearing.	Columns under 15 diams.	Across grain.	Transverse Rupture. —Shearing.— Lbs. per sq. in. Extreme fiber stress.	Modulus of elasticity.	Lbs. per sq. in. With grain.	Across grain.
Factor of safety	Ten.	Ten.	Five.	Five.	Four.	Six.	Two.	Four.	Four.
White oak	1,000	200	1,400	900	500	1,000	550,000	200	1,000
White pine	700	50	1,100	700	200	700	500,000	100	500
Southern, Long-leaf, or Georgia yellow pine	1,200	60	1,600	1,000	350	1,200	850,000	150	1,250
Douglas, Oregon & Washington fir or pine:									
Yellow fir	1,200	...	1,600	1,200	300	1,100	700,000	150	.....
Red fir	1,000	...	.....	.....	...	800	.....	...	.....
Northern or Short-leaf yellow pine	900	50	1,200	800	250	1,000	600,000	100	1,000
Red pine	900	50	1,200	800	200	800	600,000	...	.....
Norway pine	800	...	1,200	800	200	700	600,000	...	.....
Canadian (Ottawa) white pine	1,000	...	.....	1,000	...	.....	.....	100	.....
Canadian (Ontario) red pine	1,000	...	.....	1,000	...	800	700,000	100	.....
Spruce and Eastern fir	800	50	1,200	800	200	700	600,000	100	750
Hemlock	600	...	.....	800	150	600	450,000	100	600
Cypress	600	...	1,200	800	200	800	450,000	...	.....
Cedar	800	...	1,200	800	200	800	350,000	...	400
Chestnut	900	...	.....	1,000	250	800	500,000	150	400
California redwood	700	...	.....	800	200	750	350,000	100	.....
California spruce	....	...	.....	800	...	800	600,000	...	.....

THE USE OF A LOCOMOTIVE ON TRACK WORK.*

In consequence of the great business depression in the United States for the last few years, the roadmaster has had a great deal to contend with in decreased force and material, while, at the same time, he has been expected to keep his track in the same safe condition as heretofore. The section foreman has also been required to maintain his track with about two men less, and the work train to handle the material for the sections, ditching and other repairs, with a reduction of about 25% in force. Of course, the same amount of work cannot be done, and all work that can be left to take more or less care of itself for a few years is allowed to pass; but all important work is done, and done, perhaps, as well as heretofore. As a rule the most expensive item in the roadway department is the work engine; but this engine can be made one of the most important features in facilitating and economizing work, as noted in this paper:

Unloading Rails with a Chain.—Rails 45 ft. long, loaded on two 30-ft. cars, can be readily unloaded from the rear end with a 15-ft. chain, by the engine crew and eight laborers. This is done by first cutting

* Abstract of a paper on "Roadway Department Economics," by A. Morrison, Roadmaster, Lehigh Valley R. R., presented at the annual meeting of the American Society of Railroad Superintendents, held in New York Oct. 14, 1895.

off the rear car, and placing the hook of a 15-ft. chain under the track rail at a tie, and attaching the clevis at the other end of the chain to the end of the rail to be unloaded. The engine then moves ahead, and the projecting end of the rail will gradually rest on the track, forming an easy curve, until the other end of the rail drops on the track, the dropping being made easy owing to the great length of the rail, and unloading from the rear end of the car. Two men attending to this chain are all that are required, while six men with bars throw the rails out of the track. In this manner a car containing 60 rails was unloaded in 50 minutes.

Unloading Rails by Hand.—In unloading 45-ft. rails by hand, we found that it could be done at about half the expense of 30-ft. rails. Eight men on the car with tongs slide them off at the rear, while eight men on the ground carry the projecting end of the rail outside of the track, and hold it in that position while the engine moves ahead. Then the eight men on the ground move along the rail and take hold of the other end as it leaves the car, and lay it also outside of the track. In this way 16 men and an engine unloaded 100 tons of rails per day, and at the same time kept out of the way of the business of a first-class railway.

Renewing Rails with an Engine.—By stringing the new rails outside of the track in 600-ft. lengths, they can be strung so that the first stretch may be moved into its place and make a proper joint. The succeeding stretches cannot be so carefully placed, but the engine will readily move them backwards and forwards by the use of the switch rope, 15-ft. chain, or bumping stick. By the use of a 15-ft. switch rail to make connection with the old rail, it is possible in this manner to renew rails during week days and still accommodate a large traffic. If the traffic at certain times of the day is too great to change rails, or while waiting for the passage of certain trains, the men can be employed in stringing the rails, or preparing the track for the rails to be put in with the engine when the opportunity arrives.

Changing Rails.—Roads having numerous heavy curves, making necessary the changing of the high rail on account of the wear on the side of the head, may get almost twice as much wear out of the rails by transposing the inner and outer rails. There is no quicker way of doing this than by cutting the rails wherever the short rails are located, provided they are not further apart than 600 ft. By throwing both rails in, and one stretch of rails over the other, so as to change places, the engine will readily move them the required distance backwards or forwards. With 30-ft. rails and broken joints the distance is about 15 ft., and by making connections with a 15-ft. switch rail, as in renewing rails, this work can also be done and accommodate a large traffic on week days. A great advantage in using the engine is that it makes it unnecessary to remove the numerous bolts and splices (the bolts and nuts being often rusted together and difficult to unscrew), and allows of using a larger proportion of the force of men to adze and properly prepare the ties, so that when the rails are in position they conform to the desired contact with the wheel tread. By the use of an adjustable spotting board, which can be set to turn in the inner rail and the outer rail as much as desirable (I recommend the former to be ¼ in. and the latter ⅛ in.) very perfect and satisfactory work can be done, with no guessing about it.

Moving Switches by an Engine.—Occasionally it will be found necessary to move a system of switches, or a leader in a yard, to accommodate some other improvements. If the distance is not too long for a wrecking rope, or combination of short ropes, an engine can pull one turnout at a time readily, by first removing the track intervening between the old and new locations, excavating the ballast to the bottom of the ties, cutting the track loose between the turnouts, and putting 1-in. boards under the ends of the switch timbers, lapping them in the direction the switch is going to be pulled. Fasten each end of a chain around the rails and sill on each side of the switch, preferably behind a joint, and hook the engine rope to the middle of this chain, so as to prevent the strain from being greater on one side than the other, and thus twisting the switch timber. The engine will then pull the turnout to its required position. Put in the connecting rails and splice up the track. The engine now moves ahead, prepared to pull each consecutive turnout in like manner. A leader has been moved in this manner in one day, which could not possibly have been done by hand with the same force of men in ten days.

Building New Track.—Having about 20 miles of new track to build last year, we found it more economical to lay what track was to be laid with tie-plates by placing them on the ties previous to laying the rail and spiking them down with the rail, instead of putting the plates in after the track was laid and ballasted. Of course, the projections under the tie-plates did not enter the tie until the ballast engine passed over them, when they were found to go readily to their place and maintain the proper gage in doing so. Previous to allowing this engine to pass over the unballasted track, all irregularities in surface that would injure the rail were properly taken care of. Any tie-plate that is not strong enough to bear this strain without damage is entirely too expensive to apply.

Ballasting.—This track was ballasted with slag up to the bottom of the tie, and the slag was all received in quarter coal cars. Any person who ever handled slag knows what a very difficult and expensive material it is to deal with. In order to overcome this difficulty, we placed a tie immediately in front of the rear wheels of each car dumped, and dumped as many at a time as the engine could handle. By moving the train of cars, with men on the car pushing down the material with bars, it was uniformly distributed level with the top of the rail. The tie being square, slid in front of the wheels, and prevented them from being derailed. In this manner we were able to handle the slag at about half the usual cost. After the track was raised and tamped to grade, and the slag leveled so as not to extend above the bottom of the tie, anthracite ashes were distributed in like manner. By this method one engine and 18 men have unloaded in half a day 160 cars, containing 1,000 cu. yds. of ballast.

Other Uses of the Work-Train Engine.—If the work-train engine is only required to take the men to and from their work, this engine should attend to the distribution of material for the sections, which frequently require such assistance, and if it cannot be so employed it should be turned over to the transportation department from the time of delivering the men at their work to the time of taking them home in the evening. When we consider that this engine costs about $25 per day, including the crew, it will be readily seen that with a force of laborers costing $25 a day, it increases the cost of every day's labor performed 100%. Hence the practice of running a work train with a small force of laborers is an expensive luxury, and any work train composed of less than 50 laborers will make the average rate of each day's labor higher than any contractor would figure on doing work. Of course, there is always work on the railway that cannot be done by contract, and is only possible to reach by use of an engine; but the force of laborers should bear such a proportion to the cost of the engine that the cost of each day's labor is within reason.

Organization of Work Train.—To get the proper economical results from a work train, the foreman should be the conductor and share the responsibility for the safety of the train with the engineman. A conductor alone should not be tolerated, there being too many opportunities for him to sleep in the caboose, and he will consequently antagonize the foreman, who is particularly interested in and held responsible for a fair day's work. By the foreman acting as conductor he gets a knowledge of the trains that he would not otherwise have, which enables him to arrange his work to better advantage, and especially smaller items of work (which consume so much of the train's time), so that it can be done between the time of certain trains. This conductor must be an expert foreman, qualified in all branches of track work. He should be provided with an assistant foreman, thus enabling him to give more time to the trains than otherwise would be possible, and, if his force is large enough to require it, he should also be furnished with a time-keeper.

Equipment.—The engine on this train should be a passenger engine that is somewhat too old for such service, but still in fair condition and not too light. The caboose, supply car, and regular train of service cars should be equipped with air-brake and air-whistle, and whenever going a considerable distance the train should be qualified to run as a section of a passenger train with perfect safety. Much time is lost by work trains going to and from work, and in passing over the road for any considerable distance during the day, when taking their chance with the other traffic, as is the common practice.

SPECIFICATIONS FOR THE BOSTON SUBWAY.

We give herewith some extracts from the specifications for the construction of Section 2 of the Boston Subway, which has just been put under contract. The bids for the iron and steelwork were opened on Sept. 12 and for the remainder of the work on Sept. 19. The location of this section of the work is on the Common at the junction of Boylston and Tremont Sts., and the general design and construction required were described fully in our issue of May 30, 1895, and may be referred to for explanations of the different kinds of work.

The wording of specifications is a matter of great importance, as many an engineer knows by experience. The following extracts are reprinted verbatim from the official specifications, the clauses selected being those which refer to matters concerning which the proper wording is most frequently a matter of doubt. It should be explained that the work is let in two contracts. The first is for the iron and steelwork and the second is for the erection of the iron and steelwork, the excavation and masonry, and everything necessary to the completion of the work. The following quotations are from the specifications for the second contract:

Risks of Contractor.—The contractor shall, at his own expense, convey the materials from the point where they are delivered by the commission, and shall, at his own expense, store the same in the vicinity of the works. He shall take especial care to prevent the iron and steel from rusting. He shall be responsible for loss incurred or damage done to materials furnished by the commission, from the time of their delivery until the work is accepted.

The plots of borings, pipes, and other underground objects, are supposed to be approximately correct, but should they be found to be otherwise, or should the contractor encounter quicksand, springs, or other difficulties, he shall have no claim on that account, it being understood that the commission does not warrant the plot of underground objects to be correct.

The contractor shall provide such forms, and such assistance as may be required by the engineer for giving lines, grades, etc., and his marks shall be carefully preserved. Hoisting and working shall be suspended for such reasonable time as the engineer shall deem necessary to transfer lines into the trench or tunnel, and the contractor shall make no claim on that account. Special care is to be taken to insure the proper ventilation of tunnel work.

Excavation.—The trench in which the subway is to be constructed shall be excavated in all cases in such manner and to such depths and widths as will give suitable room for building the stuctures they are to contain, for plastering and coating the exterior, and for bracing and supporting, pumping and draining, and for removing from the trench peat or other material which the engineer may not deem proper for foundations.

The contractor shall furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the side of the excavation, and to prevent any movement which could in any way injure the masonry, diminish the width necessary for proper drainage, or otherwise injure or delay the work. All slides or caves are to be at his cost. The exterior sheeting and bracing shall be so arranged that it can be removed as fast as each thin stratum of backfilling is put in. (See section relating to backfilling.)

If the engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports, at the expense of the contractor, and the compliance with such orders shall not relieve or release the contractor from his responsibility for the sufficiency of such supports.

Long braces must be suitably propped by piles or posts, so as to prevent them from sagging.

No excavated material (except a limited amount of sand and gravel to be used for masonry, the limit to be determined by the engineer) shall be left on the surface; but such material shall either be backfilled into the trench or taken away as fast as excavated. If necessary, a large proportion of the carting away of surplus (the proportion to be determined by the engineer) shall be done between the hours of six o'clock in the afternoon and eight o'clock in the morning.

Filing.—The backfilling must be done in such a way that no unbalanced pressure can be thrown upon the masonry. It shall be spread in layers, not exceeding 6 ins. in thickness, which shall be well watered and thoroughly rammed; or where practicable, and the engineer so directs, it shall be thrown into the trench and allowed to settle into place through a suitable depth of water: No refilling shall be made from frozen earth.

As fast as each thin layer of the trench is refilled, the exterior sheeting, etc., shall be removed in such manner as to avoid the caving in of the trench.

When the engineer decides that the sheeting or bracing cannot be removed without injury to the work, it shall be left in place, and is to be paid for as provided in the bid.

The surface of the ground in streets, paths, and elsewhere shall in all cases be left in as good condition as it was previous to the commencement of the work; and when of gravel or broken stone, it shall be well rolled with a heavy roller if required; the whole work of refilling and resurfacing to be done in a manner to prevent, as far as possible, after-settlement. The contractor shall keep the surface over and along the trench and other excavations in a safe and satisfactory condition for a period of six months after the work contemplated in this contract is finished, and shall be responsible for any accident that occurs on account of the defective condition of such surface.

Materials.—Portland cement and American natural

hydraulic cement are to be used in the work. Both must be fine ground, of good weight, and put up in satisfactory casks or packages. The American cement must be fresh and equal in quality to the best of the "F. O. Norton" brand. The Portland cement shall be equal to the best of the "Dyckerhoff" brand. When by order or permission of the engineer cements having a higher or lower market value are used, he shall make a fair addition or deduction in the estimates on account of such change.

The cement will be subject to inspection and rigorous tests by the engineer, and none shall be used or remain on the work but that which has been approved by him.

The contractor shall at all times keep in store, at some convenient point in Boston, a sufficient quantity of cement, to allow 10 days to elapse between the time of testing and the time of using.

Basement stone masonry shall be made with stone of compact texture, free from loose seams and other defects, and laid on its natural bed.

Care shall be taken to have the beds and joints full of mortar. Each stone shall be so split (or pointed if necessary) that it will have a height not more than its depth measured perpendicular to the face; and that if placed in a rectangular box that will just contain it, no point of the face or beds will be back more than one-tenth, and no point on the back or sides be more than two-tenths of its least dimension from the corresponding sides of the box.

When work is done during freezing weather, the contractor shall provide the necessary means for, and shall heat the brick, gravel, sand, and water, and shall thoroughly protect the masonry from damage by rain and frost, during and after laying. No work shall be done on masonry during such days as, in the opinion of the engineer, good work cannot be done.

Timber Work.—Foundation piles shall be straight, sound spruce sticks, free from defects, not less than 6 ins. in diameter at their lower ends, and of sufficient length to drive well into the hard bottom, to the satisfaction of the engineer. They shall not be less than 10 ins. in diameter at the point where they are cut off for capping. Any pile broken while driving, or driven off the line, must be replaced at the contractor's expense.

The piles are to be driven in bents if required, and are to be cut off at the grade given by the engineer; the top of each pile to be exactly level after being cut off, so that the caps which rest on them will have a firm and even bearing.

Character of Work.—Water-tight work is required; and to this end, in addition to the general good quality of work required, the whole exterior of the top and side walls shall be thoroughly coated with a smooth layer at least ⅝ in. thick of roofing pitch, or similar material, which shall be furnished by the commission. This shall be so heated and otherwise treated and applied as to make an even and continuous coating, adhering closely to the surface of the subway.

Any unfaithful or imperfect work or material that may be discovered before the final acceptance of the work shall be corrected or replaced immediately, on the requirement of the engineer, notwithstanding that it may have been overlooked by the proper inspector, and estimated. Any materials condemned or rejected by the engineer may be branded or otherwise marked, and shall, on demand, be at once removed to a satisfactory distance from the work. Any omission to disapprove the work at the time of inspection, or at the time of any monthly or other estimate, shall not relieve the contractor of any of his obligations; and all work, of whatever kind, which, during its progress, and before it is finally accepted, may become damaged from any cause, shall be removed, and replaced by good and satisfactory work.

Labor.—If any person employed on the works by the contractor be disobedient, or appears to the engineer to be incompetent, unfaithful or disorderly, he shall be discharged immediately on the requisition of the engineer, and shall not be again employed on the works.

The contractor shall neither bring nor allow others to bring any spirituous or fermented liquor, or other intoxicant, upon the grounds occupied for the prosecution of the work; neither shall he furnish, or allow others to furnish, liquors, or other intoxicant, to the workmen in his employ, or to any person or persons in the vicinity. vicinity.

Necessary conveniences, properly secluded from public observation, shall be constructed wherever needed, for the use of the laborers on the work.

TIES AND POLES FOR STREET AND ELECTRIC RAILWAYS.*

Some of our tracks built with first-class pine timber in 1891 have recently been going to pieces, owing to the rotting of the timber, and a thorough examination has shown conclusively that six years is the longest life we may expect of selected pine. In taking up the tracks of horse car and dummy lines, we have frequently found oak ties of which accurate records could be had, and from these we are led to believe that eight years is the longest life we may expect of oak. On steam railways it is well known that ties covered up, and poorly drained, decay more rapidly than those in ballasted and well-drained track; and, remembering that street railway ties are poorly drained at best, and that they are, even with the best paving, liable to be wetted by every rain, and to be under a constantly changing state of dampness, and remembering, too, that the ties and rails vibrate even in the most solid construction, and hence are in contact with the air, we cannot see why street railway ties should ordinarily last longer than buried railway ties.

Inquiries made of many street railway engineers show that there is no uniformity of opinion or practice as to the best tie to use. Different engineers prefer and use oak, tamarack, chestnut, cedar, cypress and Georgia pine, and a very few engineers claim to have solved the problem of economical track construction by adopting metal ties. It seems to be generally conceded that metal ties require for their proper foundation a thorough bedding in concrete, and if it is granted (as claimed by a few American and many English and Continental engineers) that a concrete foundation is necessary in any good track, then the selection of metal ties may bespeak good judgment in deep-rail construction. Most American engineers claim that concrete is not necessary in first-class track construction, and if this opinion (in which I heartily concur) is correct, then there can be few cases, if any, where metal ties would be most satisfactory and economical.

In New Orleans excellent results have been obtained under horse car tracks with red cypress, which is reported to have been in good condition after 28 years' service. White cypress is worthless, but red and black cypress are among our most durable woods, but their extreme softness and inability to properly hold spikes have been a serious hindrance to their extensive adoption for ties. The extraordinary results reported in New Orleans are doubtless due to the light requirements of horse car service, and the fact that these ties were always in very damp, marshy earth, if not actually submerged in water.

The preservation of timber in quantity is confined almost exclusively to two long-established processes—viz., burnettizing and creosoting. Burnettizing, or the treatment with zinc chloride, is the process most extensively used in America for the preservation of railway ties, mainly on account of least cost, rendering timber fireproof, and being simpler or safer than the treatments by the injections of other metallic salts. It is extensively used in the West, and has given good results, especially in dry localities; but there are many conditions met with in street railway construction which are unfavorable to its success: 1, Zinc chloride is a salt easily washed out when exposed in wet localities; 2, Leakage currents from the rails might hasten its disappearance; 3, It has a tendency to rust the rails and spikes.

The creosoting process was invented and established in 1838 by Jno. Bethell, of England, and for many years past it has been almost universally used in England and France for the preservation of ties and telegraph poles. The average life of creosoted beech ties on the Northern Railway of France is 27 years, and properly creosoted spruce ties in England last from 16 to 20 years. It is reported that the mile of track laid with different kinds of creosoted ties on the Louisville, New Orleans & Texas R. R., near West Pascagoula, Miss., in 1869, showed, when examined in 1886, that only seven of these ties had been removed—one from rot, and six from being cut into by the rail. Many cases have been reported in this country where creosoted timber was sound after 16 years of service. Creosoted timber is in may respects peculiarly suited for street railway ties. The creosote cannot be washed out, and being a perfect insulator, is beyond the reach of the electrolytic action of leakage currents. It might have an important bearing (especially in stringer tracks) on reducing the leakage from the rails to the water mains, etc. Its tendency is to prevent iron and steel from rusting.

For a long time our standard dimensions of ties were 6×8 ins. section and 8 ft. long, but over a year ago we changed these to 5×9 ins. and 7 ft. long, and consider our present standard more satisfactory. In railway practice, where tremendous loads are carried upon low rails, it has been found that too broad a tie would rock itself out of a proper foundation in ballasted track. In street railway work, however, where deep rails are used, and where this "rocking" does not occur, a broad tie has many advantages over a narrow one.

We have recently used 3,000 sap pine ties from the Fernandina Oil & Creosote Works. These ties, treated with 12 lbs. of dead oil of coal tar (creosote) per cu. ft., can be delivered, f. o. b. cars at Atlanta, for 60 cts. each. First-class pine ties now cost us 26¼ cts. each; oak in quantity 30 cts. each, and black cypress about 40 cts. each. Under our present scale of wages, the labor of tearing up and renewing track paved with ordinary Belgian blocks, with a sand foundation and filling, will cost about 36 cts. per lin. ft. of single track, and hence we can readily make a comparison for determining the most economical tie to use.

From the information before us, we feel sure that we can safely assume 24 years as the life of a creosoted tie. Assuming the ties to be spaced 30 ins. c. to c., creosoted ties will cost 24 cts. per lin. ft. of track, therefore 60 cts. will represent the cost of labor and ties per lin. ft. in rebuilding. Principal and interest on 60 cts., 6% for 24 years, $1.46, which is the actual cost per lin. ft. of keeping ties under this track for 24 years. Similar results for other ties are shown in the following table:

These comparisons show that cypress, oak and pine will cost respectively 48%, 92% and 111% more than creosoted pine. The comparisons assume that the service of the different ties during their lives is equally satisfactory, which is practically correct in the case of oak, pine and creosoted pine, but cypress, on account of its softness, gives inferior service. No account is taken of the disturbance to travel and to residents along the street while renewals are going on, nor of the fact that repairs are necessary long before complete renewal. The prices assumed for the creosoted ties are for ties delivered by rail from a point many hundred miles distant.

Ties.	Cost of ties for ties. per ft. of track. cts.	Cost of ties and labor per lin. ft. of track. cts.	Life of tie. yrs.	Renewals in 24 yrs.	Cost of renewals (for col. 3), prin. and int. at 6%.— First ren. Yrs.	Cost. $	Second ren. Yrs.	Cost. $	Third ren. Yrs.	Cost. $	Fourth ren. Yrs.	Cost. $	Total 24 years. $
Creosoted pine	24	60	24	.	24	1.46	..	.....	..	.....	.	.....	1.46
Cypress	16	52	12	2	24	1.27	12	0.89	..	.....	.	.....	2.16
Oak	12	48	8	3	24	1.17	16	0.94	8	0.71	.	.....	2.82
Pine	10½	46½	6	4	24	0.988	18	0.842	12	0.696	6	0.551	3.077

A porous wood is necessary for proper treatment, and while beech, on account of its great toughness, seems to give the best results, spruce and sap pine are standard timbers for treatment. In many localities, especially in the South, this sap pine timber, which is in little demand ordinarily, can be had at a very low price, and these could be purchased and treated at a total cost not exceeding 40 cts. each.

Red cedar poles have been almost universally used in our overhead construction, although iron poles set in concrete have been used in the heart of the city, and cypress poles have been used in a few cases when we could not secure cedar promptly. The specifications by which most of our cedar poles were purchased required a length of 28 ft. and a minimum top diameter of 6 ins.; but these poles proved too small, and in many cases too short, especially where guard wires are required. The red cedar poles for this market are generally obtained in east Tennessee, although the timber exists more or less bountifully in many sections of the South. It has been used almost exclusively by the Western Union Telegraph Co., which estimates that its poles last on an average about 15 years. The sap wood generally decays in five or six years, and in many cases they find that the heart decays in 12 years, while, again, in many cases it will last 20 years.

Cedar poles, especially when used according to the ordinary custom, have many defects in street railway service: 1, The life is practically limited to the life of the sap, as when this decays the heart left is too small and weak for reliable service; 2, larger poles are liable to be very defective, generally being hollow at the butt, and frequently containing rotten knots; 3, it is very brittle and treacherous under tension; 4, large, short poles are excessively expensive, as they are equivalent on the market to long poles cut off. We estimate that our cedar poles with large hearts will last 12 years. They have cost us about $4 each, erected.

The iron poles, which have cost about $18 each, erected, do not appear to be lasting as well as was hoped. They have too great a tendency to rust near the ground, and we doubt whether they can be safely depended upon for more than 15 years.

Properly creosoted pine poles, 30 ft. long and 8 ins. at the top ordinarily, and 10 to 12 ins. at the top where special demands are made upon them, should be superior in point of long service to any poles on the market. These poles, treated by contract to 10 lbs. of creosote per cu. ft., should not cost more than 85

* Abstract of a paper by Mr. N. W. L. Brown, of Atlanta, Ga., presented at the annual meeting of the American Street Railway Association, held in Montreal Oct. 15 to 18.

each, erected. The creosoted pine pole should be strong enough and neat enough for city work, but it is the long life that makes this pole most eminently suited for street railway work.

Mr. W. H. Preece, the celebrated English telegraph engineer, reported in 1884, as a result of 30 years' experience, that he had never seen one properly-treated telegraph pole which showed the least decay, and he referred to 318 poles, which, after 35 years of service, were torn down to make way for larger poles, not one of which showed signs of decay. Creosoted poles are universally used in English telegraph work. The District Superintendent of the Western Union Telegraph Co. here was recently asked to examine a lot of creosoted poles, supplied to his company for experiment by the works at West Pascagoula, Miss., 12 or 15 years ago, and he found every one in perfect condition. He dug down to the bottom of many, and could find no sign of decay. Creosoted poles installed near St. Augustine, Fla., in 1888 have within the past few days been examined fully, and are reported by the Superintendent there of the Western Union Telegraph Co. to show no trace of decay. Creosoted poles have great advantage in being perfect insulators, while iron poles are grounded conductors and liable to cause accidents to the lines and linemen.

If creosoted poles are superior to cedar in almost every respect, the question naturally arises, Why are they not adopted by the Western Union Telegraph Co.? The answer to this is that most of the poles of this company are along the railways and insecurely protected against fire. A creosoted pole is very inflammable, and this one disadvantage is considered to more than offset the advantages in telegraph service.

THE CONSTRUCTION OF TELEGRAPH LINES.

On most railways the telegraph lines are built by the telegraph company in whose district the railway lies, under contract with the railway company. We publish herewith the revised rules for line construction recently issued by the Western Division of the Western Union Telegraph Co. to govern the construction, reconstruction and repair of its lines, etc., and we are indebted to Mr. R. C. Clowry, Vice-President and General Superintendent of the Western Division of this company, for the copy of the official instructions, which is reprinted below:

The minimum depth that poles should be set beneath the surface of the ground is as follows (except where rock is encountered, in which case it is only necessary to set 25-ft. poles 4 ft. and 30-ft. poles 4½ ft. in depth):

25-ft.	poles...	5	ft. deep.	45-ft.	poles...	6½	ft. deep.
30-ft.	" ...	5½	" "	50-ft.	" ...	7	" "
35-ft.	" ...	5½	" "	55-ft.	" ...	7	" "
40-ft.	" ...	6	" "	60-ft.	" ...	8	" "

In building a line the tops of the poles should be made wedge shape, so that they will completely shed rain and snow. The bottom of the wedge should be 4 ins. above the top of the upper gain. The direction of the wedge must be in a line parallel with the wires and at a right angle to the cross arms.

The slant of poles on curves should be gradual, so that the strain on the poles will be evenly distributed. All sharp curves and angles should be well braced or anchored. Braces are preferable where there is room and suitable timber is available

Braces should be set a uniform distance from the butt of the pole, at least 6 ft. when possible, and the top of the brace should be just below the bottom gain.

Anchors should be so constructed that the top of the anchor will project a sufficient distance above the surface of the ground to admit of properly attaching the guy wire to the same. Under no circumstances should the guy wire be fastened to the anchor beneath the surface of the ground.

Office poles should be guyed in such a manner as to keep the strain of the wires off the office fixtures and front of building.

Lightning conductors of ordinary line wire will be placed upon every fifth pole on new lines when being constructed, unless otherwise ordered. About 10 ft. of this wire should be formed into a flat coil and placed under the butt end of the pole; the other end of the wire to be stretched up the side of the pole and fastened to the same by 12 or more wire staples, and extended about 3 ins. above the top of the pole; on bracket lines the ground wire should be attached to the pole one-quarter of the way around from the bracket, so that if a second wire is put upon the opposite side, neither of the line wires can touch the ground wire if detached from the brackets. On cross-arm lines the ground wire should be attached to the pole on the opposite side to the cross arm.

Lightning conductors should be attached to all office poles, and when they are placed upon poles already standing, the above directions should be followed as nearly as possible, the coil of wire being placed at least 3 ft. beneath the surface of the ground.

Gains for cross arms should not exceed ⅝ in. in depth in sawed redwood poles, nor 1¼ ins. in round cedar poles that are 6 ins. or less in diameter at the top, and in no case should gains be more than 3 ins. in depth in the largest poles. The distance from the upper side of the top gain to the extreme top of the pole should be 8 ins., and the distance c. to c. between gains must be 2 ft.

When additional cross arms are added to any pole carrying two or more arms, the distance apart must be made to conform to that which may already exist upon such pole. Double cross arms should be used on all office poles, corners, and at all railway or river crossings, and on all unusually long sections. Cross arms will be fitted with sufficient steel pins to accommodate only the wires already on the line, or additional wires that are to be immediately constructed. Two bolts will be used in all cross arms.

When building a line, the cross arms should be faced alternately, first in one direction, and then in the opposite, except when it is necessary to face the cross arms in a certain direction in order to have the arms pull against the pole where bridle or line guys are used.

Cross-arm fixtures should be attached to office buildings with bolts passing through the wall instead of through door or window casing, wherever it is practicable to fasten them in this way. Never use screws for fastening fixtures to buildings, as they are liable to pull out when subjected to a heavy strain.

Wires must be tied on the side of the insulator next to the pole, except on curves or corners, where it may be necessary to place the wire on the opposite side, so that it will draw against the insulator.

The full-sized line wires should be carried to the inside of the building from the standard glass and pin insulators on a cross arm attached to the wall with iron fixtures in such a manner that the wires will have an upward direction from the insulators to the point where they enter the building, to prevent rain and moisture from following them to the wall. Where the wires run into the building in exposed places, they should be covered with a sloping roof board of sufficient width to perfectly protect them from rain and snow, and should be insulated with rubber tubing where they pass through walls and partitions, using tubing of sufficient length to go entirely through the wall from outside to inside of the building.

Where telegraph offices are located in railway stations, or similar long buildings, the wires should enter such offices at the window or other opening nearest the switchboard, and should be so strung that they can be plainly seen and easily inspected at all times.

At railway crossings all the wires must be kept at a height of not less than 25 ft. above the rails, and at public and private highway crossings not less than 18 ft. above the roadway.

In the construction, reconstruction and general repairs of lines, all splices must be soldered, except on copper wires, where McIntyre sleeves are used. All connections between copper and iron wires must be soldered.

The wires inside of a building should be insulated on porcelain knobs or wooden cleats, and kept as far apart and as far from the ground as possible. The use of staples for attaching office wires is forbidden. Porcelain insulators and knobs must not be used outside of buildings. Rubber hook insulators must not be used outside of buildings, except in places where they are completely protected from rain, snow or moisture, and where it is impracticable to use the standard glass insulation.

All connections in main battery wires must be soldered, and the wires insulated. Permanent terminal ground wires should be composed of No. 8 copper wire, soldered to the main gas or water pipes.

NEW ALUMINUM PRODUCING PLANT FOR THE PITTSBURG REDUCTION CO.

The Pittsburg Reduction Co., which is now making aluminum by means of electric current furnished by the Niagara Falls Power Co., has just placed a contract for 4,500 E. HP. with the Niagara Falls Hydraulic Power & Mfg. Co., the concern which supplies water power to the flour and paper mills located on the edge of the cliff about half a mile below the Falls. Three double-discharge horizontal turbine wheels, built by James Leffel & Co., of Springfield, O., and known as the Niagara pattern, style 28, are to be used, with a generator on each end of the horizontal shaft. The wheels will be operated under 210 ft. head, or the full pressure that can be obtained at the Falls. This is probably the highest head that has ever been utilized by turbine wheels of the ordinary American pattern. The turbines and generators will be located in a power house built on the bank of the river at the bottom of the cliff, and the electric current will be carried by cable up to the building at the top of the cliff containing the electric reduction pots in which the aluminum is produced.

The generators will be built by the Westinghouse Electric & Mfg. Co., and will be shunt-wound, revolving at a speed of 250 revolutions per minute. They will be self-contained, with outside bearings, and shafts arranged for flexible coupling at the end opposite to the commutator. They are required to carry full load for one week's continuous run without a rise in temperature of over 40°C. above the temperature of the surrounding air. The brush capacity is to be not less than 50 amperes per sq. in. of brush. When the machines are carrying their full capacity, or any portion thereof, they must not spark under a change of load of 33⅓%, providing constant speed is maintained. The machines must be so built that they will be capable of being speeded to 500 revolutions per minute without mechanical injury.

The efficiency of machines when fully loaded is to be 94%; and the rheostats are to be of sufficient capacity to cut the electro-motive force of the machines down to zero.

The Ohio River Improvement Convention met at Cincinnati, O., on Oct. 8, with President Morrison in the chair. Speeches were made by Hon. John L. Vance and Congressman B. D. Dovener, from West Virginia, and Lt.-Col. Amos Stickney, Engineer Corps, U. S. A., gave some practical hints upon the proposed improvement. The convention resulted in the permanent organization of the Ohio Valley Improvement Association, which is to collect, prepare and submit to Congress statistics and other information bearing upon the nature, extent and necessities of commerce and navigation in the Ohio Valley. The officers elected were: President, J. L. Vance; Secretary, D. P. Wilson; Treasurer, Capt. J. B. Parker. The vice-presidents were: Pennsylvania, John F. Dravo; Ohio, F. N. Laidley; West Virginia, E. A. Burnside; Indiana, John J. Ingle; Kentucky, W. W. Hite, and Illinois, W. P. Halliday. The headquarters will be in Cincinnati, O.

The interest in the Chesapeake & Ohio Canal owned by the state of Maryland is for sale, and so far three bids have been received. The state's holdings represent an indebtedness of over $15,000,000, and a majority of the stock. The Baltimore & Ohio R. R. Co., representing the canal-bondholders, bid $310,000 for the stock and mortgages of the state, and two bids were made seemingly in the interest of the West Virginia Ry. One bid was a rental of $15,000 per year paid to the state, to be extinguished by a lump payment of $300,000, payment of the bonds of 1878 and interest, payment of 25% of the face value of the construction bonds of 1844, the payment of $30,000 for a wharf property at Cumberland, and of $70,000 for labor claims. The other bid, presumably for the same company, was an offer of $526,000, conditioned upon the state wiping out all liens upon the property by having it sold at public auction under the decree of Judge Alvey, of Oct. 2, 1890. The Baltimore "Sun" deems the two last propositions impracticable, and rather favors the bid made by the trustees for the bondholders.

The dedication of the new grounds and buildings of the University of the City of New York took place with appropriate ceremonies on Oct. 19. The campus is beautifully situated on the high ground just east of the Harlem River, in the neighborhood of 183d St. It contains at present three completed structures, the Hall of Languages, the Havemeyer Laboratory and the gymnasium, and ground was formally broken for a fourth as a part of the dedicatory exercises. The new athletic field, a gift from the Ohio Society, was also formally opened. The buildings yet to be completed are eight in number, and will contain the departments of philosophy, physics, engineering, geology and biology. Two will be dormitories, and one the home of the university library. When these structures shall all have been built, the university will be very thoroughly equipped, and will be enabled to accomplish what in its former cramped quarters has been impossible. Among the graduates of its school of engineering may be mentioned William Starling, of the Mississippi Commission; the late John J. Root, of Burnham & Root, Chicago; Chas. B. Brush, Past Vice-President Am. Soc. C. E.; Geo. B. Post, John G. Van Horne, and Chas. W. Hunt, Secretary Am. Soc. C. E. The degree of C. E. is given only after five years' work, four in the course in science and one in post-graduate engineering study. In common with the other departments of the university, the school of engineering has been accomplishing much with very little money. The prospects for improvement in this direction are very bright.

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Philadelphia at this late date, according to the "Public Ledger" of that city, is overhauling her antiquated set of specifications for city work. The Director of Public Works finds them a monstrosity; without system; indefinite and impossible of enforcement, and with meaningless clauses handed down from previous and less careful generations of office-holders. Under these specifications the bidder of experience, knowing how much and how little the mere phrases meant, had all the advantage; competition was unequal, and the city paid too much for inferior work. Many examples are given of the absurdities contained in these documents, which, if literally enforced, would ruin any contractor for city work. The paving specifications are much better than the rest, but they too contain clauses which seem to be framed for the purpose of frightening would-be bidders not familiar with Philadelphia methods of interpretation. Director of City Works Thompson is now struggling with these specifications, in an attempt to obtain something less cumbersome and more efficient in the city's interest than is contained in the old forms. Philadelphia is not the only city in which this matter of inefficient or dishonestly-drawn specifications is a crying evil. Often documents are drawn up by officials new to their positions and to the service contemplated, and somewhat doubtful of their own knowledge and powers, and suspicious of those who are to perform the work. They, therefore, make a clumsy attempt to cover every chance for infraction of contract, and usually do without competent legal advice. The result is a cumbersome, meaningless or impossible specification, which cannot be enforced. In other cases, adroit and scheming officials purposely so frame specifications as to confer unlimited powers upon themselves, and make penalties and conditions so severe that no contractor not having a previous understanding with the city officials will dare to bid at all. It is manifest that with specifications drawn in either of the above ways, low bids cannot be expected, and the taxpayers have to foot bills needlessly large. Specification-making is difficult and delicate work, requiring at best the ablest legal and engineering skill and knowledge. A good specification should be explicit and detailed in its requirements, and should thoroughly guard the city against incompetent, dishonest, or careless work, and, at the same time, protect the contractor in his legal and equitable rights. In the case of important pieces of work, the field to be covered is so wide, and the details are so intricate, that it is absolutely necessary to fix upon an interpreter and final arbitrator of disputes between the parties of the first and second parts. But it is all the more essential that the utmost care, skill and experience should be expended upon the origial framing of the specifications, and that in the preparation of any important paper of this character, the services of a thoroughly competent engineer should be supplemented by those of an equally competent lawyer. Many other cities besides Philadelphia would do well to discard the antiquated, verbose and imperfect specifications under which work has been carried on for many years, and adopt in their stead documents drawn to suit modern methods of doing work, and the needs of city governments carried on upon business principles.

A fault not infrequently found in specifications for cements and cement mortars is well illustrated in the specifications for the Boston Subway which are briefly abstracted on another page. This fault consists in the adoption of a "good as the best" clause instead of stating specifically the exact physical characteristics required. It is not probable in this particular case, with the rigorous system of tests to be adopted, that a cement may be used which is inferior; but a burden is put upon the contractor and a loophole for dispute left open which might just as well have been avoided. It is stated that both natural and Portland cements "must be fine ground" and of "good weight." A moment's study will show the uncertainty under which a contractor is placed in bidding on such a specification and the chance for an almost endless dispute. To be sure, the variation of opinion is in a degree limited by the statement that the natural cement must be equal to the best of the "F. O. Norton" brand and the Portland cement to the best of the "Dyckerhoff" brand, but these statements only limit the degree of indefiniteness. Both the "F. O. Norton" best brand and the "Dyckerhoff" best brand vary somewhat in fineness and weight, as ordinarily sold; and even if they did not, the engineer has to decide upon some specific degree of fineness and weight, strength and time of setting, below which these cements cease to belong to the "Best" brand. It is not easy to see why such figures should not have been used and the contractors given definitely to understand just what was to be required of them. The only sure way of knowing the quality of a hydraulic cement from even the most reliable makers is to test it; and the best specification is one which plainly states just what tests must be met.

The Massachusetts Highway Commission is rapidly solving the problem of better roads in that state, and by systematic, thorough work upon short sections of improved roads it is giving the people of Massachusetts the best object lesson possible. It is showing the people how to build good roads, and at the same time it is teaching them the material worth of better roads, as compared with old conditions. As a result the scheme of highway improvement is becoming popular all over the state, and while $400,000 was appropriated by the last legislature for this purpose, it is said that the coming legislature will apply $1,000,000 to this work in accordance with the recommendations of the Commission. Petitions have been received for over 700 miles of improved highways, to be constructed under the present law; and the active working of the scheme is better witnessed in the report of Commissioner McClintock, who says that over 30% of the towns thus petitioning have already purchased new road machinery, and propose to push the work of general improvement on their own account. Under the supervision of the experts of the Highway Commission, and with the practical lessons taught by scattered short sections of good highways, a grade of road-building ability has been developed in these sections that will be of permanent value to the several towns. The Commission reports that the roads now built by the town contractors equal those constructed under Boston experts in the parks of that city, and Prof. Shaler says he would be willing to enter them in competition with the famed French road-builders for any number of selected miles of road. The aim of the Commission is to build thoroughly; to carefully test all road-surfacing or road-building materials; to keep an accurate and complete record of cost; to practically experiment with road machinery, and finally, to put all this information at the service of the people of the state. The material gain in freight transportation is being made plain to the users of roads, and Professor Shaler shows that, in terms of freight transportation, certain manufacturers in Cummington, Hampshire County, are as far removed from Boston as if they lived beyond Omaha. In another county an improved road about five miles long, has reduced the cost of hauling ore from a mine from 70 cts. to 20 cts. per ton. These are practical points that the mass of the people can understand and appreciate, and as it is the voters that make the legislature and practically appropriate the sums needed for state highways, this general awakening to the new conditions is absolutely essential to any radical progress in road improvement.

The secret of the present popular enthusiasm on this head and the consequent success of the Massachusetts system may be found in the methods followed by the Massachusetts State Highway Commission, and primarily in the men forming this Commission. These men, experts in the problems to be solved, have gone to work earnestly and conscientiously to show the people what better roads really mean, as affecting the material interests of the users of roads; and then, by building isolated sections of roads under the supervision of trained superintendents, they are teaching the people how good roads should be built and what they should cost. By using local contractors and educating men in the towns of the state in the details of thorough construction the Commission is most effectively developing not only the popular desire for improved roads, but it is also providing the means for carrying this desire into effect. The lesson taught to other states is that legislation alone is of little value in general highway improvement, and that mere place-holders make poor road-builders. Thorough system, well studied out and put into practice by competent men, is working a practical and practicable reform in Massachusetts, and the system, if honestly applied, should do the same anywhere else.

In our editorial comments upon the changes in the Brooklyn Bridge terminals, published in our issue of Oct. 17, it should have been stated that those in charge of the structure are not entirely responsible for the arrangements which are being generally criticised. The engineers have not had a free hand in the design or execution of the work, but have been hampered and overruled by local political influence and parties with private ends to serve. These latter interests have, in some cases, been powerful enough to secure legislative action adverse to the interests of the public using the bridge, and their work is evident at both terminal stations. As to the awkward arrangement and ridiculous appearance of the station of the Kings County Elevated R. R., the responsibility appears to rest with the railway company, the Bridge authorities having been desirous of making a comprehensive and systematic arrangement of the elevated railway terminal and the Bridge terminal.

RECENT PROGRESS IN IRON AND STEEL MANUFACTURE.

A review of the editorial correspondence which has appeared in our columns during the past month describing various recent improvements in iron and steel works, leads to the conclusion that the iron and steel manufacture is now passing through a period of transition and revolution similar to that through which the blast furnaces of the country passed in the ten years following the panic of 1873. During that time, it will be remembered, there were erected a great number of new blast furnaces of vastly greater capacity than the older ones, with the result of permanently putting out of blast hundreds of smaller furnaces, and practically destroying the industry in many sections of the country.

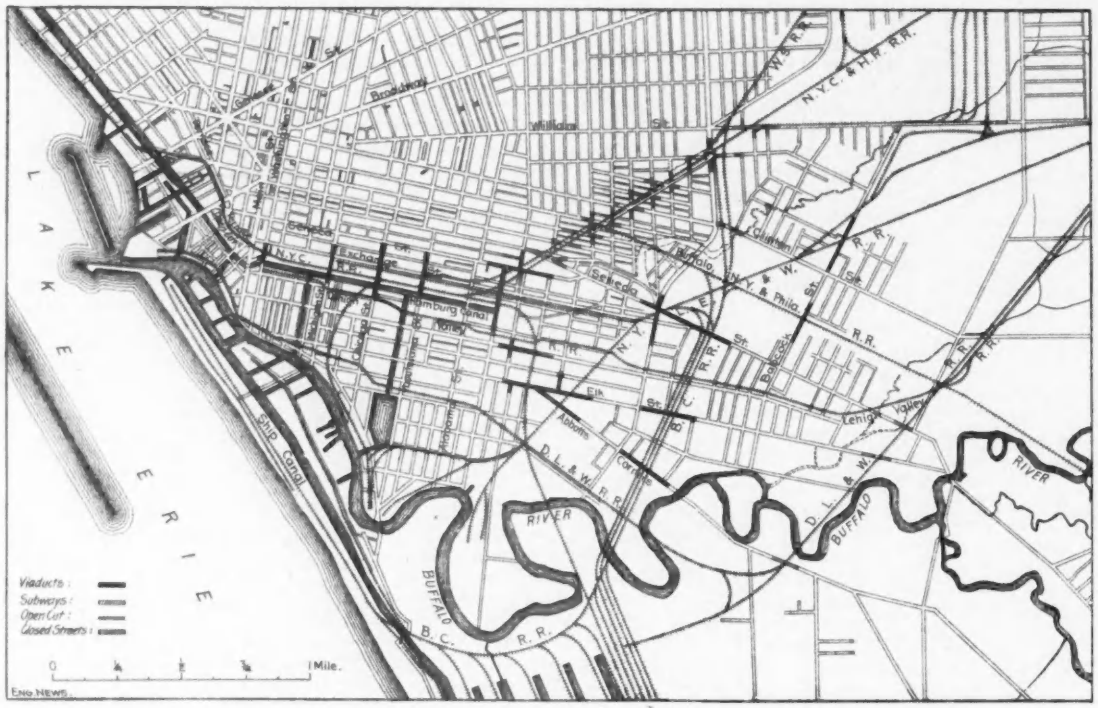
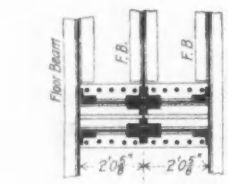


FIG. 1. MAP SHOWING EXTENT AND CHARACTER OF GRADE CROSSING IMPROVEMENT WORK.



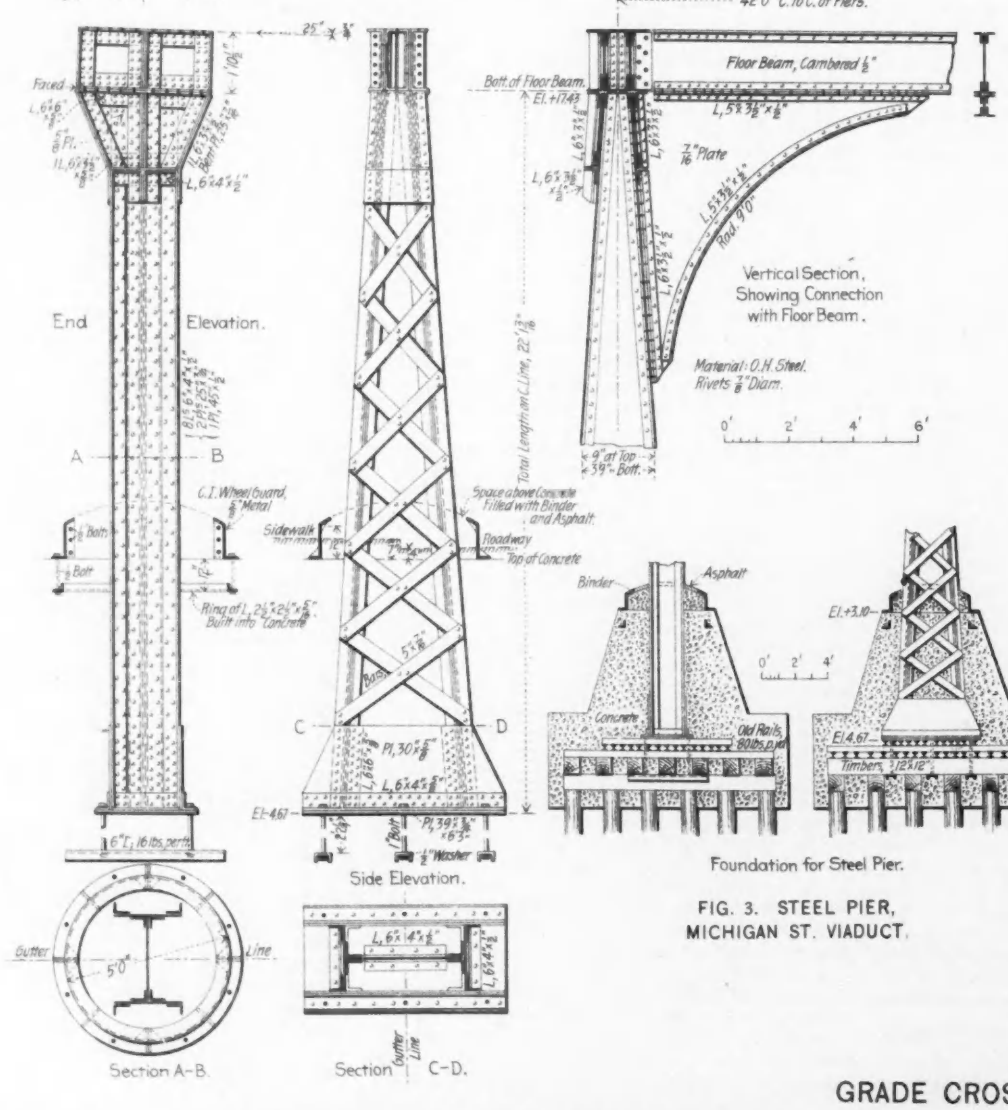


FIG. 3. STEEL PIER, MICHIGAN ST. VIADUCT.

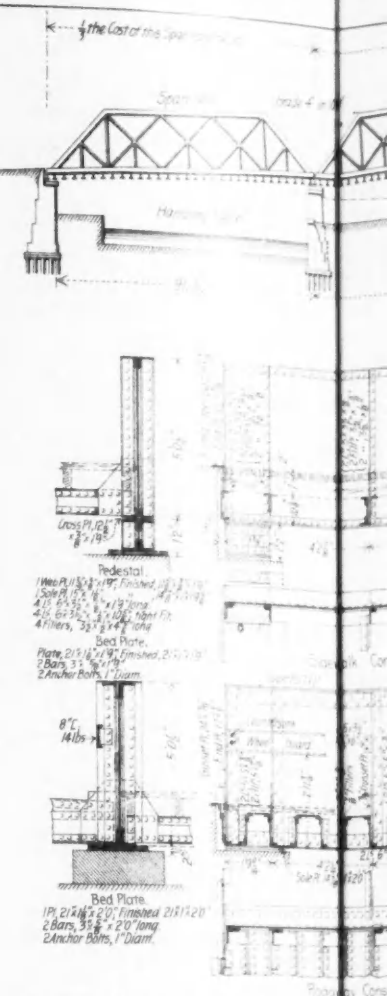


FIG. 9. PLATE GIRDER CONSTRUCTION, W

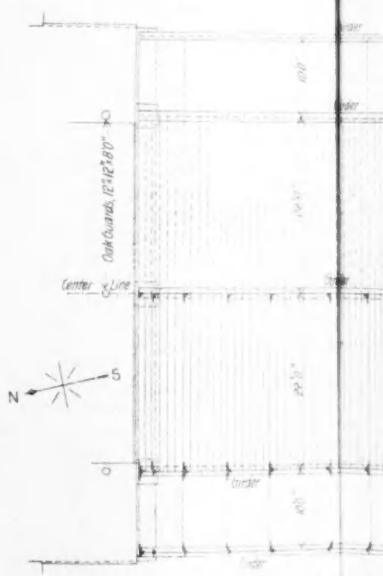


FIG. 8. PLAN OF WASHINGTON ST. VI

GRADE CROSSING IMPROVEMENT, NEW YORK CEN

Walter Katte, M. Am. Soc. C. E. Chief Engineer; F. W. Wilson, Jun. M. Am. Soc. C. E., Bridge Engineer, N. Y. C

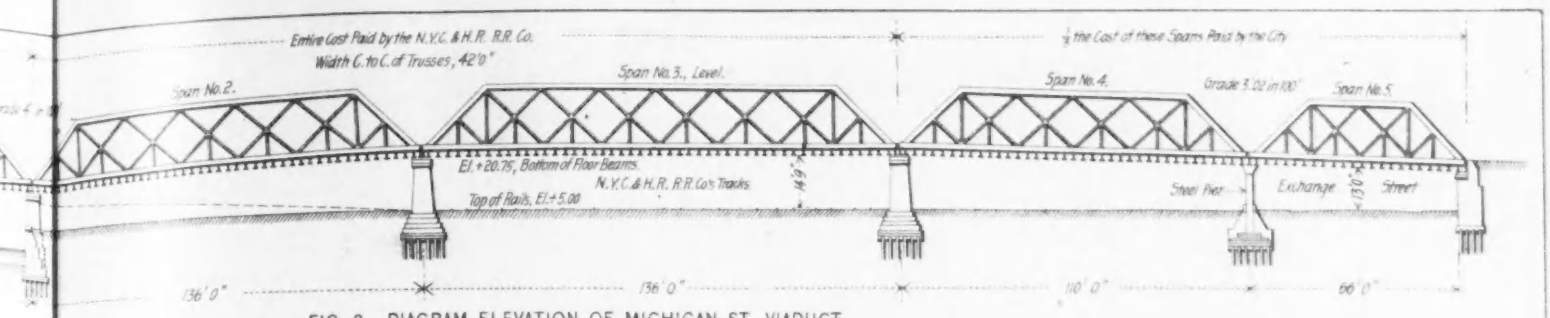
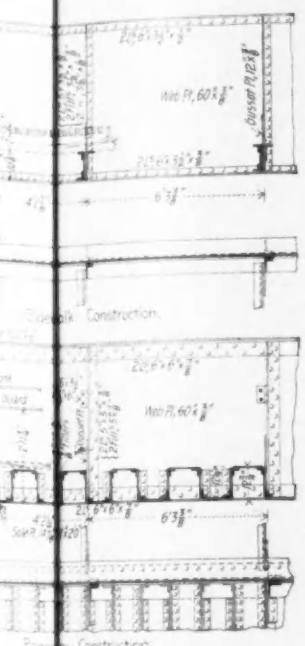


FIG. 2. DIAGRAM ELEVATION OF MICHIGAN ST. VIADUCT.



STRUCTION, WASHINGTON ST. VIADUCT.

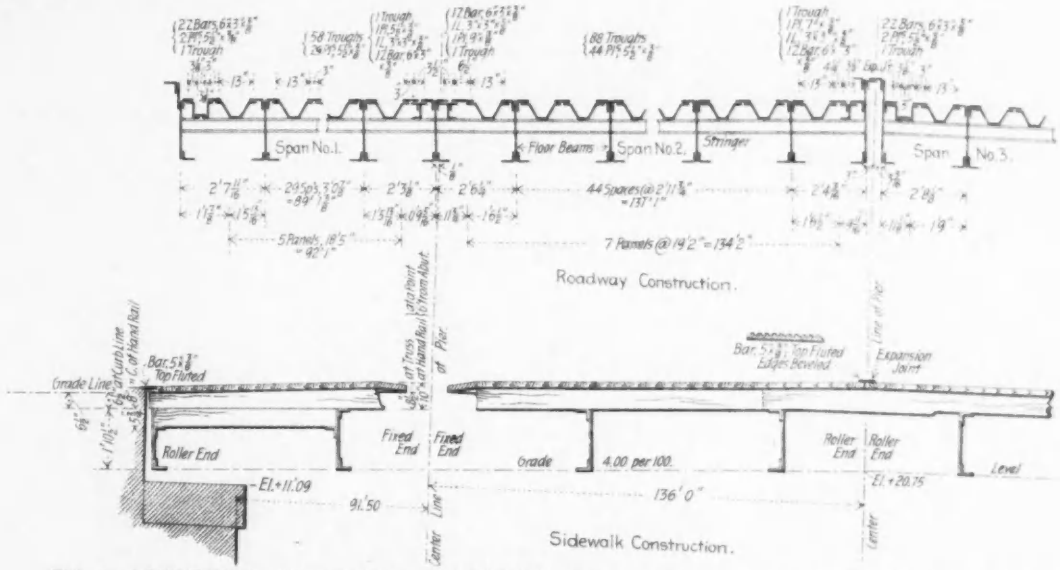
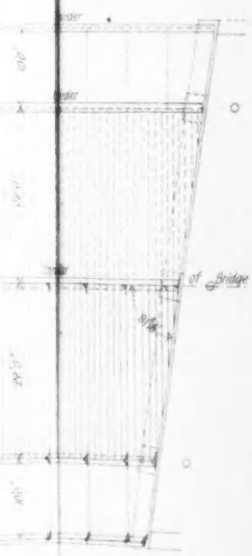
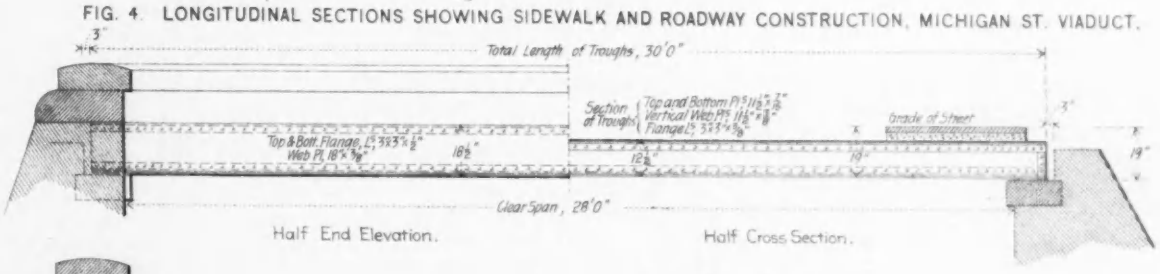


FIG. 4. LONGITUDINAL SECTIONS SHOWING SIDEWALK AND ROADWAY CONSTRUCTION, MICHIGAN ST. VIADUCT.



NGTON ST. VIADUCT.



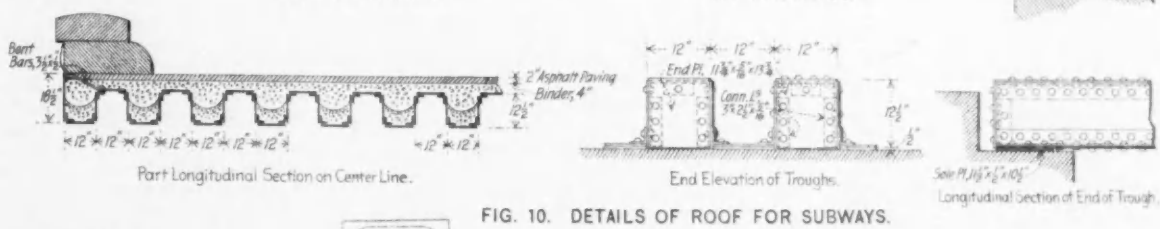
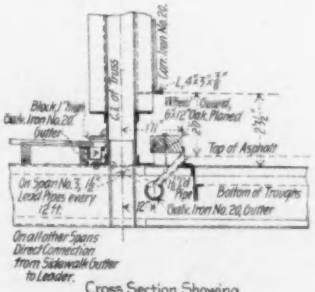


FIG. 10. DETAILS OF ROOF FOR SUBWAYS.



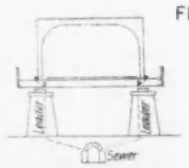


FIG. 5.
DETAILS OF DRAINAGE SYSTEM,
MICHIGAN ST. VIADUCT.

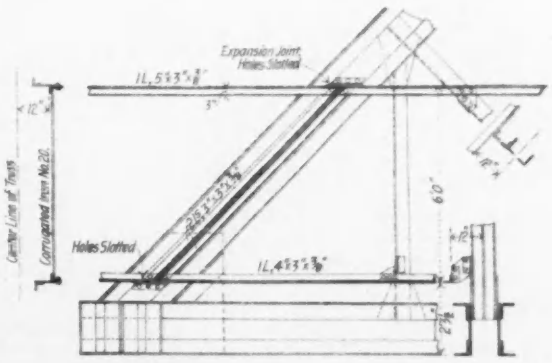


FIG. 6. DETAILS OF CORRUGATED IRON FENCING, MICHIGAN ST. VIADUCT.

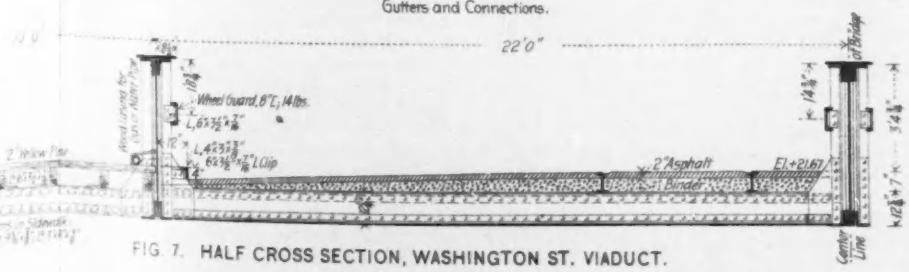


FIG. 7. HALF CROSS SECTION, WASHINGTON ST. VIADUCT.

ORK CENTRAL & HUDSON RIVER R. R., BUFFALO, N. Y.

eer, N. Y. C. & H. R. R. R. Geo. E. Mann, M. Am. Soc. C. E., Chief Engineer, Buffalo Grade Crossing Commission.

CHAS. HART & SONS, LITH., 25 VESEY ST., N. Y.

The blast furnaces of New England, New York and New Jersey suffered most severely in the struggle, and eastern Pennsylvania to a less extent, while Pittsburg began to take that position of pre-eminence in the manufacture of pig iron which she had before held in rolled wrought iron, and which she now holds in all three branches of pig iron, wrought iron and steel. The development of the Lake Superior ores and of Connellsville coke gave a permanent trend to the movement of the center of the iron manufacture from the East toward the West. At a later date came the competition of the Southern furnaces in foundry pig iron, which led to such low prices that neither Southern nor Northern furnaces, unless built in exceptionally good locations, could make any money. The revolution in the pig iron industry it now practically complete. The location of the cheapest good ores on Lake Superior and of the best coke near Pittsburg, where also is the largest market for finished iron, fixes the leading centers of the Western pig iron manufacture at Pittsburg and on the southern shore of Lake Erie. Between these points, as at Youngstown, O., pig iron may continue to be made to supply the local demand, while a certain territory may also be supplied by works located at points as widely separated as Buffalo, Chicago and Duluth, using the same ores and coke as the Pittsburg works.

Eastern Pennsylvania's pig iron industry has seen its best days. Some furnaces may continue indefinitely on the ore supply from the great Cornwall bank, or with competing ores from Lake Superior, Cuba and Spain, together with the local brown hematites, a certain proportion of which may still be cheaply mined. Southern competition in foundry irons may restrict the territory to be supplied by eastern Pennsylvania furnaces, but it will not cause the extinction of those that are well equipped and well located. As for the Southern furnaces, they are permanently handicapped by their distance from market and by the leanness of their ores. They can produce iron more cheaply than any other section, but the distance from many of the Northern markets is so great that they must sacrifice their profits to enter them. But when the Southern local market increases, with the erection of finishing works in the South, the Southern furnaces will find their proper field in supplying local demands.

As for the rolling mills and steel works, the impending revolution is not between different locations, but between different individual mills, and between old methods and new As the large blast furnaces drove the small ones out of existence, so the large steel works will eventually cause the stoppage of smaller works. Labor-saving machinery is now the absolute essential to the success of a steel works, and no works can hope to long survive that does not make provision for the practically automatic handling of the material throughout the works from the raw to the finally finished state. The description of the works at Duquesne, Pa., and at Youngstown, O., in our issues of Oct. 10 and 17, shows to what an extent this saving of labor can be carried.

In a steel works built on the latest and best plans, the pig metal is furnished by a row of blast furnaces, the ore and fuel for which are loaded and charged by machinery; the melted pig metal is conveyed first to mixers, where uniformity of composition is assured, then to the Bessemer department, where it is converted into steel, rolled into finished shapes and piled on cars ready for shipment with practically no other labor than the pulling of levers to open hydraulic valves or operate electric controllers. The scrap is carried back to the Bessemer converters and remelted. A complete modern works will have its own machine shop for repairs, and if located near a coal mine its own coke ovens, from which it may utilize the waste heat. The waste heat from the blast furnaces should generate enough steam in the boilers to drive the rolling mill as well as the blast furnace blowing engines, and compound condensing engines may be employed in order to effect this saving of steam. If extra boilers are needed for the finishing departments of the mill, they may be supplied with automatic stokers.

The building of such a plant requires an immense outlay of capital, and the interest, repairs and depreciation of plant, together with a proper contribution to a sinking fund to provide for replacement of the old works by new as they become obsolete, may amount to a larger total than the whole amount paid for wages of workmen. The struggle for existence of the smaller rolling mills in the future will be not against the difficulties of any particular location, but against aggregations of capital in the shape of massive automatic machinery, and in the consolidation of all branches of the industry, from the mining of the ore and coal to the finishing of the product ready for final consumption in one establishment. The industrial revolution thus outlined will of course go on slowly. Although a steel works can be built and put in operation in ten months, as was done at Lorain, O., it is not so easy to obtain the capital for building the works. The present revival in the iron trade may prolong the life of the small rolling mills for some years, but when the next great trade depression comes it will place them in the already long list of abandoned works.

Form of Plate (Dimensions in ins.)	To Find the Working Pressure in lbs. per sq. in. For a Flat Plate of Given Thickness (All Dimensions in ins.) Factor of Safety = 8. Let p = Safe Pressure, lbs. per sq. in., R = Rad., T = Thickness, S = Tensile Strength of Metal in lbs. per sq. in., f = (Coefficient Derived from ½S in Equation in Last Column).							
	Cast Iron, S = 20,000	W't Iron, S = 48,000	Best Steel, S = 80,000	Aluminum Bronze, Al. 10%, Cu. 90%, S = 90,000	Cast Brass, Cu. 66 + Zn. 33%, C. Other, S = 25,000	General Application.	Equation.	
Circular Plate of Radius R, Supported at the Edges.	$p=3{,}000\times\frac{T^2}{R^2}$	$p=7{,}200\times\frac{T^2}{R^2}$	$p=12{,}000\times\frac{T^2}{R^2}$	$p=13{,}500\times\frac{T^2}{R^2}$	$p=3{,}750\times\frac{T^2}{R^2}$	$p=Sf\times\frac{T^2}{R^2}$	$f=.15$	$p=\frac{6}{40}S\times\frac{T^2}{R^2}$
Circular Plate of Radius R, Secured at the Edges.	$p=3{,}750\times\frac{T^2}{R^2}$	$p=9{,}000\times\frac{T^2}{R^2}$	$p=15{,}000\times\frac{T^2}{R^2}$	$p=16{,}875\times\frac{T^2}{R^2}$	$p=4{,}687\times\frac{T^2}{R^2}$	$p=Sf\times\frac{T^2}{R^2}$	$f=.1875$	$p=\frac{3}{8}S\times\frac{T^2}{R^2}$
Plate Strengthened by Stays, a, ins. from C. to C.	$p=11{,}250\times\frac{T^2}{a^2}$	$p=27{,}000\times\frac{T^2}{a^2}$	$p=45{,}000\times\frac{T^2}{a^2}$	$p=50{,}625\times\frac{T^2}{a^2}$	$p=14{,}062\times\frac{T^2}{a^2}$	$p=Sf\times\frac{T^2}{a^2}$	$f=.3625$	$p=\frac{6}{16}S\times\frac{T^2}{a^2}$
Rectangular Plate, Sides a, and b (a≥b), Secured at Edges.	$5000\times\frac{T^2\times(a^2+b^2)}{a^2\times b^2}=p$	$p=12{,}000\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$	$p=20{,}000\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$	$p=22{,}500\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$	$p=6{,}250\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$	$p=Sf\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$	$f=.25$	$p=2{,}5\times\frac{T^2(a^2+b^2)}{a^2\times b^2}$
Square Plate, Side a, Secured at Edges.	$p=10{,}000\times\frac{T^2}{a^2}$	$p=24{,}000\times\frac{T^2}{a^2}$	$p=40{,}000\times\frac{T^2}{a^2}$	$p=45{,}000\times\frac{T^2}{a^2}$	$p=12{,}500\times\frac{T^2}{a^2}$	$p=Sf\times\frac{T^2}{a^2}$	$f=.50$	$p=4{,}5\times\frac{T^2}{a^2}$

Form of Plate (Dimensions in ins.)	To Find the Necessary Thickness for a Flat Plate Exposed to a given Pressure in lbs. per sq. in. (All Dimensions in Ins.) Factor of Safety = 8. Let p = Safe Pressure, lbs. per sq. in., R = Rad., T = Thickness, S = Tensile Strength of Metal, lbs. per sq. in. f = (Coefficient Derived from ½S in Equation in Last Column).							
	Cast Iron.	Wrought Iron.	Steel.	Aluminum Bronze.	Cast Brass.	General Application.	Equation.	
Circular Pl. of Rad. R, Supported at Edges.	$T=0.018257\,R\sqrt{p}$	$T=0.007765\,R\times\sqrt{p}$	$T=0.006257\,R\times\sqrt{p}$	$T=0.006668\,R\times\sqrt{p}$	$T=0.01633\,R\times\sqrt{p}$	$T=\frac{1}{\sqrt{8f}}R\sqrt{p}$	$f=.15$	$T=\sqrt{\frac{1}{6S}}\times R\sqrt{p}$
Circular Pl. of Rad. R, Secured at Edges.	$T=0.01633\,R\times\sqrt{p}$	$T=0.010541\,R\times\sqrt{p}$	$T=0.008848\,R\times\sqrt{p}$	$T=0.007687\,R\times\sqrt{p}$	$T=0.014606\,R\times\sqrt{p}$	$T=\frac{1}{\sqrt{5f}}R\sqrt{p}$	$f=.1875$	$T=\sqrt{\frac{R}{3S}}\times R\sqrt{p}$
Plate Strengthened by Stays, a, ins. from C. to C.	$T=0.009428\,a\times\sqrt{p}$	$T=0.006085\,a\times\sqrt{p}$	$T=0.004741\,a\times\sqrt{p}$	$T=0.004144\,a\times\sqrt{p}$	$T=0.008433\,a\times\sqrt{p}$	$T=\frac{1}{\sqrt{8f}}\,a\sqrt{p}$	$f=.3625$	$T=\frac{\sqrt{2}}{3\sqrt{S}}\times R\sqrt{p}$
Rectangular Pl. Sides a and b (a≥b), Secured at Edges.	$T=0.01633\,a^2\times b\sqrt{\frac{p}{a^2+b^2}}$	$T=0.010541\,a^2\times b\sqrt{\frac{p}{a^2+b^2}}$	$T=0.007687\,a^2\times b\sqrt{\frac{p}{a^2+b^2}}$	$T=0.006668\,a^2\times b\sqrt{\frac{p}{a^2+b^2}}$	$T=0.014606\,a^2\times b\sqrt{\frac{p}{a^2+b^2}}$	$T=\frac{1}{\sqrt{5f}}\,a^2b\sqrt{\frac{p}{a^2+b^2}}$	$f=.25$	$T=\frac{1}{\sqrt{6S}}\,a^2b\sqrt{\frac{p}{a^2+b^2}}$
Square Plate, Side a, Secured at Edges.	$T=0.01a\times\sqrt{p}$	$T=0.006455\,a\times\sqrt{p}$	$T=0.005\,a\times\sqrt{p}$	$T=0.004714\,a\times\sqrt{p}$	$T=0.008944\,a\times\sqrt{p}$	$T=\frac{1}{\sqrt{8f}}\,a\sqrt{p}$	$f=.50$	$T=\frac{1}{2\sqrt{3}}\times a\sqrt{p}$

ENG. NEWS.

FORMULAS FOR THE STRENGTH OF FLAT PLATES.

LETTERS TO THE EDITOR.

LOCATION OF KELLEY'S ISLAND.—CORRECTION.

Sir: In your interesting article on the government lock at Sault Ste. Marie in your issue of Sept. 26 you locate Kelley's Island in the Detroit River. Allow me to suggest that the island in question is in Lake Erie, lying about 12 miles north of Sandusky, O., near the mainland. The outcrops of Devonian limestone on the island and on the mainland are quarried extensively. Very truly, Coles A. Raymond.

1,233 Miami St., Toledo, O., Oct. 2, 1895.

THE CAPSIZING OF A BRIDGE CAISSON.

Sir: There has been considerable excitement in this section, caused by the capsizing of a caisson which is being placed for the drawspan of the new bridge which is being built by the South Beach Ry. Co. across the Matanzas River, in St. Augustine, Fla., on Oct. 17. The following extract from the local papers gives the facts in the matter:

On Wednesday, everything was apparently complete for filling the caisson, and its lowering by the screws, which were to guide it to the river-bed. Before the filling with concrete had gone far, it was noticed that one of the piles supporting the framework about the caisson had settled, and was not a support. Another was driven, and was pushed under the frame corner, and the work of filling continued, until some 500 barrels of concrete had been placed in the cylinder, a matter of about 35 tons. This, with the great weight of the iron cylinder and platform, was supported by 12 piles, distributed about a space of 24 × 24 ft., and about 26 ft. above the river-bed, with a 4½-mile tide running. Below the framework there was no other support but the 12 piles mentioned, and one of ordinary intelligence would see the terrible strain on the four screw rods to which the caisson hung, and upon the topheavy framework suspended on the breast of a heavy ocean tide. It was noticed, therefore, yesterday morning, that something was "wrong." There should not have been any mystery in that fact, in the understanding of a mechanic, for nearly three-fourths of the 35 tons of concrete in the caisson was on the west half, and something had to let go. It did so, for the screw rods on that side felt the full strain, and as they could not unwind themselves, they went, taking the frame on that side with them, breaking the timbers, 12 × 18 ins., square off, and the caisson lies now, at an angle of 45°, on the river bottom in the west channel of the to-be draw.

I am not prepared to say who is to blame for the accident. Mr. W. F. Broughton, of Jacksonville, Fla., is the contractor for the work. He has with him Mr. J. W. Summerville and Mr. E. M. Wheeler, said to be the engineers. Yours truly, Pat.

St. Augustine, Fla., Oct. 19, 1895.

FORMULAS FOR THE STRENGTH OF FLAT PLATES.

Sir: Enclosed find a blueprint of formulas relating to the strength of flat plates under different conditions, of which two or three appeared in your issue of Sept. 5. The blueprint is a compact, convenient form of well-known formulas relating to the subject. While such formulas are aids in figuring dimensions and pressures, they should be used with care, allowance being made for the various conditions of the metals. The writer will appreciate any corrections of errors which may be found in the formulas.

Yours respectfully, F. A. Boland.

59 Chestnut St., Hartford, Conn., Sept. 9, 1895.

REACTIONS OF PARTIALLY CONTINUOUS DRAWBRIDGES.

Sir: With reference to the discussion on the reactions of partially continuous drawbridges now going on in your columns, I may, as a matter of priority, point out that the method of least work was used to determine these reactions in an article contributed by me to "Engineering," and published on Dec. 7 last. In the example there dealt with it was found that, as Mr. Chas. Steiner points out in his letter published by you in your issue of Sept. 26, the work done on the web members had a considerable effect in modifying the reactions. Thus, in the case there considered, the stresses in the chords above the central pier were 15% greater when no account was taken of the deformation of these members than it was when the work done on them was included in the total.

Yours faithfully, H. Medway Martin.

39 Guilford St., London, W. C., Oct. 10, 1895.

ELECTRIC CARS ON STEAM RAILWAYS.

Sir: With regard to the operation of electric and steam trains on the same track, allow me to call your attention to a short line between Pottsville and Minersville, Pa. This road is about five miles in length, and on it are run both steam and electric trains, at regular intervals. The line is owned by the People's Railway Co., this company having leased to the Schuylkill Electric Railway Co. the privilege of operating electric trains on its tracks, in connection with the street railway system of the town. I enclose a blueprint of a photograph of one of the combination cars used by the Schuylkill Electric Ry. Co. on the above-mentioned line, also a print of the steel work of the new power house recently built for it, furnished by the Pottsville Iron & Steel Co. Yours truly, Richard W. Knight.

Pottsville, Pa., Oct. 12, 1895.

(The car referred to is of exceptional length, and is carried on two four-wheel trucks, with all wheels braked. About a third of the length of the body is occupied as a baggage compartment, and the end platforms are enclosed by vestibules. Some of the passenger cars on this line, weighing about 14 tons, are equipped with the Hunt air-brake. The power house is a two-story structure, with the second floor supported by plate girders on four rows of steel columns, while the roof is formed of steel trusses, spanning the distance between the side columns.—Ed.)

THE EFFECT OF NEIGHBORING ARTESIAN WELLS ON EACH OTHER.

Sir: It has been known from experience in many places that the sinking of one artesian well will affect

the flow of others near by which are supplied with water from the same stratum. The Denver artesian basin is a marked instance of this. The following information with regard to an interesting case in this basin was received too late to incorporate in the "U. S. Report on Artesian Wells" (Senate Executive Documents, 51st Congress), abstracted in the Engineering News.

As the facts here given may be of more general interest, I send them to you. The information was obtained from C. P. Allen, Chief Engineer and constructor of the water-works of Denver.

L. G. Carpenter,
Professor of Engineering and Physics.

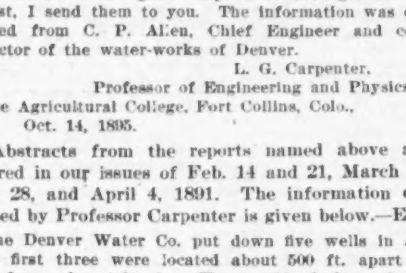
State Agricultural College, Fort Collins, Colo.,
Oct. 14, 1895.

(Abstracts from the reports named above appeared in our issues of Feb. 14 and 21, March 14 and 28, and April 4, 1891. The information enclosed by Professor Carpenter is given below.—Ed.)

The Denver Water Co. put down five wells in all. The first three were located about 500 ft. apart in the form of a triangle. The combined flow of the three did not exceed that of the first one after they had run one week. We then sank the fourth well, 1,500 ft. from the first wells. That one diminished the flow of the first three some, but not to the same extent as the second and third diminished the first. We then put down No. 5, about 400 ft. from the first wells, and while we could detect by actual measurement a decrease in the flow of Nos. 1, 2, 3 and 4, the amount of decrease was so small that it was necessary to measure in order to detect the difference. I then made a careful survey of the location of different wells about the city, and came to the conclusion that wells located within one mile of each other would affect each other more or less. I then began to experiment some by pumping into wells, and found that we could cap up wells Nos. 2, 3 and 4, and by pumping into No. 1 increase the flow of No. 5, located nearly 5,000 ft. away. Two years after the wells were put down we pumped into them with the same results. All of our wells were cased from top to bottom and perforated opposite each flow. We used rubber packing between the flows or water strata to prevent the wells from discharging outside of the casing. The first flow was located about 150 ft. from the surface of the ground. From there to the surface we filled around the casing with Portland cement, so I do not think we had any leaks outside the casing, as a great many wells put down about Denver have. Our wells, when first put down and capped up, indicated a pressure of 21 lbs. per sq. in. They were allowed to run freely, after the first few months, discharging into a reservoir. From that time they gradually decreased, until the flow is quite small from Nos. 3, 4 and 5. Nos. 1 and 2 have ceased to flow. The discharge of No. 3 is about 20 ft. lower than Nos. 1 and 2. All of these wells were about 700 ft. deep.

A NEW AND SIMPLE METHOD FOR CONSTRUCTING AN ELLIPSE.

Sir: A true ellipse being a figure rather difficult to construct, several methods for constructing approximate figures composed of circular arcs have been published, all of which give figures approximating more or less closely to the true ellipse. For this purpose the method explained below will give a rather more satisfactory figure than any other approximate method known to the writer, and is extremely simple. The circular arcs of which the resulting figure is composed are truly tangential and, while it is not a true



A New Way of Constructing an Ellipse.

ellipse, it is probably the nearest approach to it, as well as the best proportioned figure, that can be obtained by means of four circular arcs.

The method of construction is shown in the accompanying sketch, and is as follows:

Draw the major and minor axes, A B and C E. From their intersection, O, lay off upon the minor axis the distances O c and O e, each equal to d, the difference between the axes. O c = O e = d = A B — C E. Upon the major axis lay off from O the distances Oa and Ob, each equal to ¾ d. Through the points thus located upon the axes draw the lines c F, c G, e H and e K, as shown. The line c C will be the radius and c the center for the arc F C G, the line b B will be the radius and b the center for the arc G B K, etc.

The resulting figure will be graceful and, for many purposes, satisfactory. When the difference between the axes is small, the figure obtained will closely approximate a true ellipse. The error will increase as the ratio between the axes increases, but the arcs will be truly tangential and the general appearance of the figure graceful in any case in which the major axis is materially less than three times the minor axis. In comparing the figure obtained by this method with a true ellipse, and also with those obtained by several of the published methods, all of which were somewhat similar, but less simple, this method was found to give a rather more satisfactory figure than any other method compared. That the circular arcs are truly tangential may be shown as follows (see illustration):

The point c on the minor axis being located by the distance d, it is required to ascertain the distance x, locating the point b on the major axis in such position that a straight line drawn through the points c and b will coincide with the radii, c G and b G, of the adjacent arcs, F C G and G B K.

Let M represent the major axis, A B; m, the minor axis, C E; R, the longer radius, c G; and r, the shorter radius, b G. M — m = d ; x and y are unknown.

$$R = \frac{m}{2} + d$$

$$r = \frac{M}{2} - x$$

$$y = R - r = \frac{m}{2} + d - \left(\frac{M}{2} - x\right)$$

$$x = y + \frac{M}{2} - \frac{m}{2} - d = y - \frac{d}{2}$$

From the right-angled triangle,

$$x^2 = y^2 - d^2$$

By equating the values of x^2,

$$y^2 - d^2 = y^2 - d\,y + \frac{d^2}{4}$$

$$y = \frac{5}{4}\,d.$$

By substitution,

$$x = \frac{5}{4}\,d - \frac{d}{2} = \frac{3}{4}\,d.$$

Therefore, by making the distance x equal to ¾ d, the radii, c G and b G, of the two adjacent arcs, F C G and G B K, will coincide, and the arcs will have a common tangent at G.

The circumference of this ellipse is equal to 1.6467 M + 1.4949 m.

The writer claims originality for this method and believes it to be here for the first time published, although he, of course, recognizes the possibility of it having been previously known, and even published, without the fact coming to his knowledge.

Benj. F. La Rue.

Scranton, Pa., Feb. 14, 1895.

ENGINEERING OPPORTUNITIES IN MEXICO.

Sir: In my visits to the principal towns of the wealthy state of Vera Cruz, I have been impressed by the opportunities here exhibited for the advantageous investment of American capital, and I wish to use your journal as a means of communicating to investors some general information, which may prove of value to them. The state of Vera Cruz, amongst whose rich productions may be noted coffee, vanilla, cocoa, sugar, rice, tobacco and many other articles of produce, in addition to a variety of mining products and fine marbles, is, generally speaking, unprovided with means of conveying these productions to the railway lines for shipment. There is almost an entire absence of electric or other forms of light railways connecting the towns not on the trunk lines, and, as a consequence, great difficulty is experienced in handling the articles of export. The rapid development which might reasonably be expected from this rich region, were there adequate transportation facilities for its products, is not realized.

Recently some disposition has been shown to remedy this condition, but unfortunately all efforts in this direction have been confined to one locality, the counties of Jalapa and Coatepec, when there are many others offering equal or better advantages. Three applications have been made to the general government for permission to build an electric road between Jalapa and Coatepec counties, touching the towns of the same names, through the former of which the Interoceanic Ry. passes. The petitioners are Mr. John D. Rodriguez, Mora & Co., and Gen. John B. Frisbie. In addition, there is already in existence between these towns a road built some years ago, which it is the intention of the owner, Mr. Philipp Magarrasa, to extend to Teocelo, and eventually to a point on the Mexican Ry., thus connecting two great trunk lines. Active work is now in progress on the latter enterprise, the Teocelo extension being pushed to an early completion under the supervision of Mr. Fred Adams, Assoc. M. Inst. C. E., from whom my information has been obtained. Electricity is to be the motive power of this road, and one of the numerous waterfalls of the region is to be utilized for its generation, 1,500 HP. being the maximum obtainable. The electrical machinery for the plant will be bought in the U. S., through J. Arce & Co., a well-known firm in the City of Mexico. This system once introduced and its great advantages and economy of operation recognized, other lines will follow and will create a demand for street car machinery which will be of great profit to manufacturing firms in the U. S.

The competition which will result, however, should all the projected lines between Jalapa and Coatepec be built, will be apt to prove disastrous to the companies' earnings. There is really not traffic enough to support two lines. For this reason I regret that all efforts in the direction of light railway construction have been confined to the Jalapa region. The undeveloped counties of Misantla, Papantla, Tuxtla and many others of this state offer as great opportunities for investment in railways, factories and other enterprises.

Yours very respectfully, R. H. Martinson.

Jalapa, V. C., Mexico, Oct. 8, 1895.

"DOES INSPECTION INSPECT?"

Sir: In your issue of Aug. 29, Mr. A. C. Cunningham wrote on the subject "Does Inspection Inspect?" and Mr. Alexander Potter, in another letter, raises the question whether inspectors in steel works are necessary. These letters have so far brought out no comment, and have apparently not received the attention which the importance of the subject warrants. This may be because neither writer makes clear just why he writes at this time. Mr. Cunningham speaks of "The present agitation about inspection matters in Pittsburg and elsewhere," but does not explain what the agitation is. This omission may be supplied as follows: On June 27, Mr. Jno. McLeod, Engineer of Tests of the Carnegie Steel Co., issued a circular letter as follows:

We desire to call your attention to the fact that the condition of trade is such as to force us to the adoption of every means possible to facilitate the handling of material at our mills, in such a manner as to avoid any and every unnecessary delay, and to this end we have expended every effort within our own organization.

One of the principal causes of delay is the methods of surface inspection, adopted by outside inspectors, who wait until their material has been placed on the shipping beds before making this inspection. This practice you will recognize as one which causes very serious delay.

In view of the foregoing, we have decided that on and after July 1, 1895, all surface inspection of material on orders subject to your inspection, will be required to be made by you at the time of rolling, and at a place between the rolls and the shipping beds, and that no material is to be rehandled on the shipping beds for the purpose of inspection.

In the event of material being rejected on the results of tests, should such cases arise, you will, of course, be given an opportunity to separate the rejected material from that which has been accepted.

In the event of your not being able to have a representative present at the time of rolling (day or night), we will agree to make this surface inspection ourselves, and furnish you with a certificate to that effect, guaranteeing to replace any material found to be defective after shipment.

Requesting that you arrange to make your surface inspection as indicated in the foregoing, and co-operate with us in this matter, we remain, etc.

Since then the circular has been modified so as to apply only to the shape mills. At the plate mills at Homestead and Upper and Lower Union Mills, "the inspection will be as heretofore, on the shipping beds."

There has been quite a general disposition to accept the plan proposed by Mr. McLeod, partly because of the difficulty of getting the material on any other terms, and partly because the plan has commended itself. In view of these facts and some others, Mr. Cunningham raises the question broadly whether an inspector accomplishes anything valuable under the conditions found in a great steel plant, and gives his reasons with much candor and force.

It is true, as Mr. Cunningham says, that the complete identification of test pieces is practically impossible. No inspector, and probably no half dozen inspectors, could go into the Homestead plant of the Carnegie Steel Co., for example, and keep such tally of tests and material as would absolutely identify it piece by piece and melt by melt. To keep check and tally on the operations of the thousands who labor there is only possible through an organization and system on a scale with that of the steel company itself.

But precisely in the same degree that this identification is difficult to an inspector does any systematic falsification become difficult on the part of manufacturers. Great manufacturing plants are managed by systematic organization. It is impossible to handle them otherwise. Men employed in them do from day to day certain work, keep certain records, make certain reports, or take a part in making certain products; but not one in a thousand of them knows whom the products are for or why orders for making one lot differ from those for another. Any one can easily become familiar

with the methods of identification and of keeping record of product in a great steel plant, and in a few days' observation can satisfy himself whether it is a systematic formal transaction, under standing orders, or whether it is not. The observation of the writer is that this must necessarily be the case, and that the falsification of records must therefore either originate at headquarters or else will be done so awkwardly as to be readily detected.

It is true, again, as Mr. Cunningham states, that test pieces are generally selected and prepared by the manufacturer. This is, indeed, his prerogative under most specifications, so long as inspectors are satisfied the work is honestly done. But when in doubt on this point, or to satisfy themselves about it, inspectors have the privilege at any time to select tests or to have check tests made elsewhere. Also, in the case of retests, inspectors, as a rule, do make the selections, and clearly always should. The fact that there is little friction on these points is evidence that there is little reason for it.

Far from thinking with Mr. Cunningham, then, that tests made at steel works for the reception of material are less valuable than formerly, I think them much more so. It was an easy matter to cook up tests or to roll special bars for tests in the days of wrought iron, and such practices were not uncommon. But with steel the system of marking by melt numbers and testing by melts makes such work much more difficult.

The system of making tests at the steel works before shipment in the presence of inspectors is, in principle, right and desirable for many reasons, which need not be set forth now, and if there are grounds of sufficient importance to warrant a radical change, the writer is confident they have not yet been developed. On the contrary, is not the great mass of testimony favorable to the general correctness of the results, and is the improvement in manufacture due to this system?

While disagreeing thus with Mr. Cunningham's views on mill testing, the writer is entirely in sympathy with the ideas of Messrs. Potter and Cunningham on the value of special or check tests. Any one who follows such a plan for a year will develop a surprising amount of information which can be had in no other way. The reason why we are now at a standstill in testing steel is not because we have inspectors and a system of tests, but because specifications are at fault and there is not sufficient data to correct them. The best of the specifications provide simply that manufacturers shall furnish "a test" from each melt of steel or from each melt and each section. This gives manufacturers a range of selection which is often much greater than people are aware of; and just what the facts are no one not connected with manufacturing is fully able to declare. It is this fact that halts many enterprising inspectors for two quite different reasons: The first is because if they declare that tests shall be cut from such and such places, manufacturers can interpose a veto on the ground that so long as they present bona-fide tests, the specifications ask for nothing more; and the second is that they know that specifications are based on "regular" rather than special tests, and are in much doubt regarding the views which principals will take of facts which are at variance with their ideas and specifications.

The remedy for this state of affairs does not lie in any one man's hand, nor in that of any group of men; it must be based first on facts and represent then the concerted action of engineers in council. The first step in a reform in methods, then, is the accumulation of facts, and a system of special tests on the lines suggested by your correspondents is the way to do this.

Of the various check tests which have been suggested and tried, the experience of the writer is that there is none so readily applied and so convincing as check analyses. A large part of the structural steel is now bought under specifications covering process of manufacture and fixing chemical limits more or less fully. Check analyses will determine the impurities, and generally the process, and can readily be made at any time either from test pieces, from croppings, or from punchings in the shop. The announcement that check analyses will be made puts manufacturers on the qui vive as nothing else seems to do. From the steel furnace to the loading skids, greater care is everywhere apparent in making or in accounting for the material.

Frederick H. Lewis.

406 Locust St., Philadelphia, Oct. 12, 1895.

NOTES OF A JOURNEY FROM DENVER TO LOS ANGELES.

Sir: The visitor to Denver is invariably impressed by the fine appearance of its buildings. A city ordinance has for some years prohibited the erection of frame buildings inside the city limits. The new buildings erected during the past few years are solid, handsome structures, largely of stone. All the streets in the business portion of the city have been paved with asphalt, and this work, which had just begun when the writer visited Denver in August, 1890, is being extended all over the city, so that the streets have become the paradise of the bicyclist. It is stated that there are now 20,000 wheels in use in the city.

Substantial improvements have been made in the erection of new bridges, one at 38th St., which is a handsome two-span, three-truss structure, recently completed by the Youngstown Bridge Co., and the Broadway bridge, under construction by the same company, which is the full width of Broadway—100 ft.—and is of plate girders 125 ft. 4 ins. long and 10 ft. deep, carrying buckle-plate floor and paving.

Notwithstanding the serious inroads made on the electric railway traffic by the bicycle, a franchise has been obtained for a new line to Golden, Colo.—to go out one avenue to the north and return via Colfax Ave. The Denver, Lakewood & Golden Ry. is also making preparation to build some new lines, and it is confidently expected they will be the first to build a new line over the mountains to Grand Junction.

The trip westward from Denver over the Denver & Rio Grande's new line through Leadville is made much more comfortable than many trips of equal length in the East. The progress made in irrigation at Canyon City, Grand Junction and other points during the last few years is phenomenal, and the Grand Junction peach has become noted for the peachy flavor of "our grandfather's orchard."

At Salt Lake City the electric railways have pushed out in every direction, the broad streets affording splendid facilities.

The Mormon Temple and Tabernacle are the principal sources of wonder to the tourist. The Temple is, perhaps, the most solidly-constructed granite structure in this country, and its severe vertical lines add much to the impression of height. The Tabernacle is, however, the most interesting structure for an engineer's study. From a photograph taken during its construction, the roof is found to be constructed with huge elliptical arch ribs of timber, each rib being about 10 ft. in depth, of Town lattice trussing, the diagonals being pinned together with four parallel and approximately equidistant ribs of about 12-in. timbers. The falsework used in the erection, and, in fact, the entire structure, would seemingly do credit to a modern engineering firm. This great arched roof was originally covered with wooden shingles, but in the last two or three years these have been replaced by metal shingles, much improving its appearance.

The new salt water resort at Saltair is reached by train from Salt Lake City, and boasts of the finest pavilion of any resort in the country, a huge Oriental building with domes and minarets. It was described and illustrated in Engineering News of Nov. 9, 1893.

There can be little doubt that a railway will be completed next year between Salt Lake and Los Angeles, as it is almost a necessity to the future development of the West that the immense coal and iron fields of southern Utah and Nevada be opened up.

San Francisco will at last have the long-desired railway competition in the San Francisco & San Joaquin Valley Ry., which is being backed by the Spreckels family. The work on the road is actually under way, the contracts for the bridges all let, and it will be completed at an early date, the entire length of the San Joaquin Valley to Bakersfield.

The new union depot and ferry house at the foot of Market St. is well under way, and will be both an ornament to the city and a much-needed improvement. The foundation and ground floor, 100 ft. wide by 659 ft. in length, is founded on piles crowned with concrete piers; the piers, which are approximately 20 ft. apart, are connected by monolithic concrete arches, built up to the level of the first floor. The depot will have the entire framework of steel, the exterior being of buff Roman brick. A lofty square tower in the center will add much to its imposing character. The foundation work was executed by the San Francisco Bridge Co., and the architect is Mr. A. Page Brown, of San Francisco.

At Los Angeles the Atchison, Topeka & Santa Fe R. R. has erected a handsome station of brick and stone (La Grande station), and has laid out a park adjacent to it, planted with palms and semi-tropic flowers. Railway circles here are full of talk about the new Orient Express of the Santa Fe, which will make the run from Chicago to Los Angeles in three days and half an hour—a distance of 2,300 miles—much of it over mountain and desert.

This company is building many new stations in this section, designed on the lines of the old California mission stations, and which harmonize well with their surroundings.

Los Angeles has made remarkable progress in the past three years. Many new business blocks have been constructed, the most notable being the Bradbury block, of brown stone, and the Stimson block, of pressed brick, either of which would do credit to an Eastern city. Of the thousands of new dwellings which have been built, most show a decided improvement in the class of architecture. Some very pretty adaptations have been made of Japanese roofs, Italian villas, mission architecture and Colonial styles.

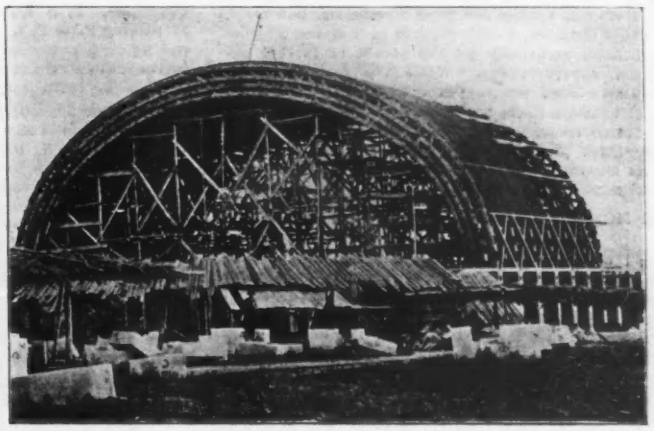
Pasadena, which is more than ever a suburb of Los Angeles, has added many costly residences, a large number of which are finished on the exterior in plaster. The frame of the house being covered either with wire net or perforated steel laths, affords a firm hold for the plaster, and the house has the appearance of being built with solid cement walls and arches.

The two cities are connected by the Terminal Ry., the Santa Fe, and the Pasadena & Pacific Electric Ry., which makes the trip of 12 miles in 50 minutes. The Southern Pacific is completing a line which will make the run in 20 minutes.

The entire street railway system of Los Angeles will be electric in a month or two, as work has begun on changing the Downey Ave. and First St. cable lines to electric, and the Main St. horse car line is reported sold to the Traction Co., a new corporation, which has splendid electric equipment and is arranging to build a line to Whittier.

Both the electric railways and the steam locomotives

OIL WELLS IN THE CITY OF LOS ANGELES.



ARCHED ROOF OF THE MORMON TABERNACLE, SALT LAKE CITY, UTAH.

on local runs are using fuel oil under the boilers. This has become very cheap, owing to the great oil development in the city. Two years ago oil was found on Beaudry St., only a few blocks from the center of the city. It is a very heavy asphalt oil, with a specific gravity of 15° Beaume, and when flowing from the pipes resembles liquid asphalt.

Immediately on its discovery nearly every one owning property in the vicinity sank a well. The average depth is 800 ft. On many small lots there are now two or three wells. Over 300 wells are now down, and the possible production is about 3,000 barrels per day. The oil is being used for fuel, lubricating, printing inks and the like, but the restricted market keeps the yield down to about 1,500 bbls. per day, and the price down to 30 or 40 cts. per bbl.

An oil exchange is being formed to pipe the oil to the ocean, and by means of tank steamers supply San Francisco. This will probably have the effect of raising the price to $1 or more, but as 3½ bbls. are equal to 1 ton of coal, it will even then be as cheap as coal at $3.50 per ton. This oil field is a great boon to Los Angeles, as coal has cost here $10 to $12 per ton in small lots.

The oil fuel is making a prosperous concern of the Los Angeles Iron & Steel Co., operators of a rolling mill in the city. This firm is rolling sheet steel for use in the manufacture of steel pipe for irrigation and mining, and also manufactures corrugated iron, for which it finds a good market. It supplies nearly the entire coast, and ships as far east as Arizona and Texas.

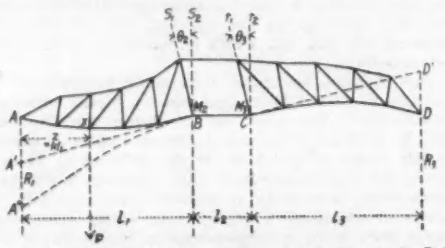
The question of Southern California harbor improvements is still in abeyance. The building of the great double-track pier and wharf 6,000 ft. into the ocean at Santa Monica by the Southern Pacific Co. has drawn attention from San Pedro, the real port of Los Angeles, which must eventually get the benefit of further government appropriations. While the contending factions have been warring over these two places, Redondo, between them, has gone steadily ahead, building up a large trade, and at the time of my visit a new double-track pier and wharf were nearing completion for its accommodation.

C. E. Fowler.

Youngstown, O., Oct. 8, 1895.

THE MOMENTS OF STRESSES IN SWING SPANS WITH FOUR SUPPORTS.

Sir: I was very much interested in the very able article in Johnson's "Theory and Practice of Modern Framed Structures" on swing bridges, written by J. W. Schaub, M. Am. Soc. C. E. There is one place, however, where I am inclined to think the author is in error. It is in the equations on page 194, which relate to trusses resting on four supports, and so hinged over the two center ones that the moments are equal at those two points. Long-span drawbridges are usually designed to give a close approximation to this condition, by practically omitting the web members in the center panel. It is accomplished in various ways; sometimes by actually omitting the web members; sometimes by connecting the tops of the posts over the two central supports to the other members of the truss, by means of short vertical links; sometimes by attaching the diagonals in the central panel to the posts, several feet from the ends, sometimes by making these diagonals very light, etc. The type of this truss is shown in the accompanying cut.



We will employ the following notation: Let A, B, C, D represent a truss resting on four supports, A, B, C and D, with continuous chords, but with the web members omitted in the portion B C. Let A B = l_1, B C = l_2, C D = l_3, reaction at A = R_1, reaction at D = R_3, moment at B = M_2, moment at C = M_3, and let span A B be loaded with a load P at x. Let A x = k l_1 = z.

Mr. Schaub's first equation on page 194 becomes, with this notation,

$$M_2 = M_3 = -\frac{P\,l_1^2}{2\,l_1 + 3\,l_2}(k - k^3) \qquad (1)$$

He derives it from equation (9) on page 181, which assumes that $l_1 = l_2$, by placing the moments at B and C equal. He would have obtained the same result if he had made the same assumption in equation (1) on page 179, which is the general equation of the theorem of three moments:

$$M_{r-1}\,l_{r-1} + 2\,M_r\,(l_{r-1} + l_r) + M_{r+1}\,l_r = -\Sigma\,P_r\,l_r^3\,(k - k^3) - \Sigma\,P_r\,l_r^3\,(2k - 3k^2 + k^3). \qquad 2)$$

Under the present notation, $M_{r-1} = 0$, $M_r = M_2$, $M_{r+1} = M_3$, $l_{r-1} = l_1$, $l_r = l_2$, $\Sigma\,P_{r-1} = P$ and $\Sigma\,P_r$ = load in B C = 0. As this does not assume $l_1 = l_2$, and as equation (1) might have been derived from it, we will not assume them equal in the present discussion. Now, since equation (1), as it has just been derived, involves neither the length nor loading of span C D, his application of it seems absurd.

The theorem of three moments assumes a beam to be perfectly rigid in its resistance to shearing, but elastic in its resistance to bending. In this case there is no resistance to shearing in B C, and it seems to me, therefore, that the theorem is not applicable. In many practical cases R_3, as determined by equation (1), is greater than R_1, for loads at the first panel-point to the left of B, which seems to me hardly reasonable. Again, if $l_2 = 0$, equation (1) gives,

$$R_3 = \frac{-P}{2}(k - k^3),$$

whereas the correct value of R_3 for a center-bearing bridge of two equal spans is

$$\frac{-P}{4}(k - k^3),$$

as Mr. Schaub gives it in equation (8), on page 180, a discrepancy which seems difficult to explain.

The question may be asked, How may we interpret Mr. Schaub's equations? Simply thus: He has placed $M_2 = M_3$, and determined their value according to the assumed values of k, P, l_1 and l_2. Now if we apply the theorem of three moments to the spans B C and C D, and assign the value already found to M_2 and M_3, we shall obtain an equation of the same form as (1), involving P_3, l_3, k_3, and known quantities. It is indeterminate, but may be satisfied by placing $P_3 = P$, $l_3 = l_1$, and $k_3 = k$—i. e., any beam resting on four supports may be so loaded that the moments at B and C are equal, and if $l_1 = l_3$, they will be equal if the beam is symmetrically loaded.

Let us now attempt a correct solution of the problem Mr. Schaub has in hand. Referring again to the figure, let B S_1 and B S_2 be drawn normal to A B and B C respectively, and θ_2 = angle S_1 B S_2. Similarly let θ_3 equal the angle between the normals to B C and C D at C. Draw B A′ tangent to A B at B. Also let B A″ be the curve assumed by A B, when deflected from the position A′ B by the load P. Draw C D′ tangent to C D at C. Since B C contains no web members, it will remain straight under strain, the only effect of the strain being to make $\theta_3 < \theta_2$. Now $\theta_2 - \theta_3$ is equal to the angular deflection of the tangent at C of a beam whose moment of inertia equals that of the truss B C fixed at B, and strained by the moment M_2.

Let E = the modulus of elasticity of the truss and I its moment of inertia, then by the common theory of flexure,

$$\theta_2 - \theta_3 = -\frac{M_2\,l_2}{E\,I} = \frac{-R_3\,l_2\,l_2}{E\,I}, \qquad (3)$$

since R_3 and M_2 are negative.

$$\theta_3 = \frac{D\,D'}{l_3} = \frac{-R_3\,l_3^2}{3\,E\,I}, \qquad (4)$$

D D′ being the deflection of C D due to R_3.

A′ A″ = deflection of A B due to

$$P = \frac{P}{E\,I}\left[\frac{(l_1 - z)^3}{3} + \frac{z\,(l_1 - z)^2}{2}\right] \qquad (5)$$

$$A\,A' = l_1\,\theta_2, \qquad (6)$$

A A″ = deflection of A B due to

$$R_1 = \frac{R_1\,l_1^3}{3\,E\,I} \qquad (7)$$

$$M_2 = M_3 = R_3\,l_3 = R_1\,l_1 - P\,(l_1 - z), \qquad (8)$$

Combining (5), (6), (7), we have,

$$\frac{R_1\,l_1^3}{3\,E\,I} - l_1\,\theta_2 = \frac{P}{E\,I}\left[\frac{(l_1 - z)^3}{3} + \frac{z\,(l_1 - z)^2}{2}\right] \qquad (9)$$

Substituting the value of θ_2 from (3) and (4), and multiplying both members by E I, we have,

$$\frac{R_1\,l_1^3}{3} + l_1\,R_3\,l_2\left(l_2 + \frac{l_3}{3}\right) = P\left[\frac{(l_1 - z)^3}{3} + \frac{z\,(l_1 - z)^2}{2}\right]$$

Substituting the value of R_1 from (8), we have,

$$\frac{l_1^2}{3}\,R_3\,l_3 + P\,(l_1 - z)] + l_1\,l_3\,R_3\left(l_2 + \frac{l_3}{3}\right) = P\left[\frac{(l_1 - z)^3}{3} + \frac{z\,(l_1 - z)^2}{2}\right]$$

whence,

$$R_3 = \frac{-P\,(l_1^2 - z^2)\,z}{2\,l_1\,l_3\,(l_1 + 3\,l_2 + l_3)}; \qquad (10)$$

whence by placing z = k l_1,

$$M_2 = M_3 = \frac{-P\,l_1^2\,(k - k^3)}{2\,(l_1 + 3\,l_2 + l_3)}. \qquad (11)$$

If we place $l_1 = l_3$ and $l_2 = 0$, in (10) we shall have,

$$R_3 = \frac{-P}{4}(k - k^3),$$

which is identical with Mr. Schaub's equation (8) on page 180, as it should be.

If we make $l_1 = l_3$, and load span C D symmetrically with A B, we shall have,

$$M_2 = \frac{-P\,l_1^2\,(k - k^3)}{2\,l_1 + 3\,l_2}$$

which is identical with (1), as it should be, since in this case the omission of the web members in B C does not affect the moments at B and C.

Since writing the above, Engineering News of Sept. 5 has come to hand, containing an abstract of Professor Merriman's paper read before the American Association for the Advancement of Science, giving, among other things, a solution of the particular case of this problem, in which $l_1 = l_3$, and his results agree with those above given.

Very truly yours, W. Whited.

New Britain, Conn., Sept. 6, 1895.

(We submitted a proof of the above letter to Mr. Schaub, and append his reply as follows: Ed.)

Sir: The criticism offered by Mr. Whited is correct, as far as it applies to the formulas in "Framed Structures," but his statement that the "theorem of three moments" is not applicable to the condition of a swing bridge, as set forth in Art. 176, p. 193, of that work, is not correct.

The fact is that the formulas given in "Framed Structures," on p. 194, have not been properly developed from the theorem of three moments.

Going back to p. 181, when r = 3, equation (9a) should be

$$M_2\,l_2 + 2\,M_3\,(l_2 + l_3) = -P_3\,l^2\,(2\,k - 3\,k^2 + k^3) \qquad (9a)$$

Then on p. 194, when $M_2 = M_3$, we have from equations (9) and (9a)

$$M_2 = M_3 = -\frac{l_2}{4\,l + 6\,l_2}\left[P_1\,(k - k^3) + P_3\,(2\,k - 3\,k^2 + k^3)\right]$$

for a single load P in first span

$$M_2 = -\frac{l^3}{4\,l + 6\,l_2}\,P\,(k - k^3),$$

making $l_2 = \frac{l}{n}$; equation (17) becomes

$$M_2 = -\frac{P\,l}{4 + \frac{6}{n}}(k - k^3) \qquad (17)$$

Equation (19) becomes

$$R_1 = P\left\{1 - k - \frac{1}{4 + \frac{6}{n}}(k - k^3)\right\} \qquad (19)$$

Equation (20) becomes

$$R_3 = -P\left\{\frac{1}{4 + \frac{6}{n}}(k - k^3)\right\} \qquad (20)$$

When l_2 becomes 0, n = 0; then equations (19) and (20) become

$$R_1 = \frac{P}{4}\left\{4 - 5\,k - k^3\right\}$$

$$R_3 = \frac{P}{4}\left\{-k + k^3\right\}$$

which are the same as given for a continuous girder with two equal spans, as they should be.

The error arose in developing the pier moments, M_2 and M_3, for a three-span continuous girder, with a load in the first span only, and then placing them equal to each other, an assumption that must lead to absurd results.

The writer begs to thank Mr. Whited for his kindly and valuable criticism.

Yours truly, J. W. Schaub,
M. Am. Soc. C. E.

Hamilton, Canada, Oct. 9, 1895.

NOTES AND QUERIES.

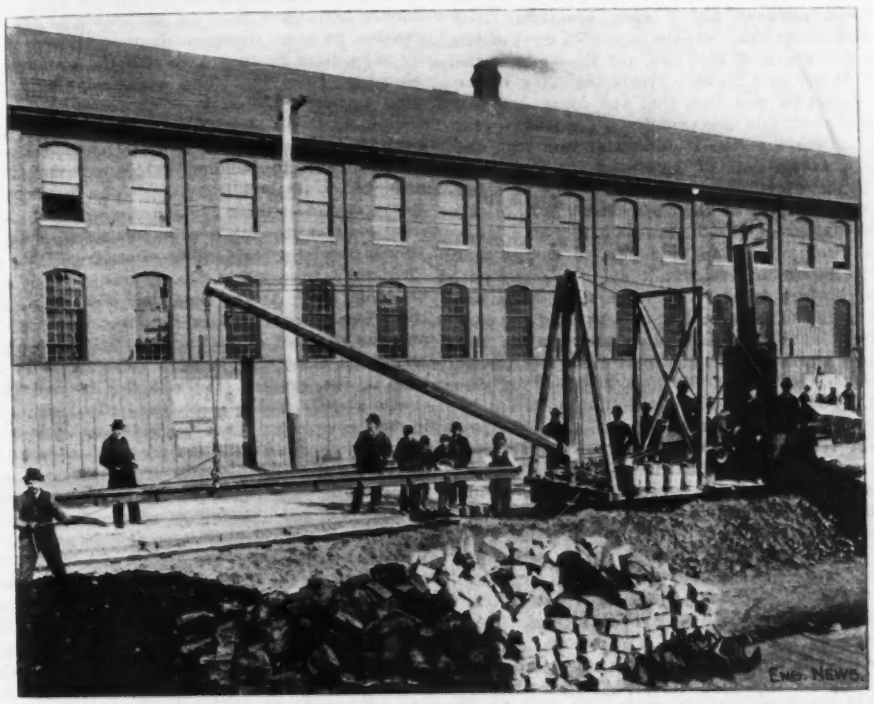
X, Y, Z writes: "In the very interesting articles published in Engineering News of Oct. 10 in regard to the iron and steel industries in and about Pittsburg I find no mention of the amount of horsepower required at any of the works. Would you kindly inform me as to the amount of horsepower used, for example, to run the engines at the Edgar Thomson Works to produce the blast for the stacks? Could you also give some idea as to cost of horsepower at these large works?"

A complete description of the Edgar Thomson Works was published in our issue of Nov. 1, 1890. The total power used was not stated, but the dimensions of boilers and engines were given, from which it can be readily computed. The cost of power for blast furnace blowing engines is very small, as the item of fuel is practically eliminated; the gas from the furnaces is burned under the boilers, and usually gives sufficient heat to make all the steam required.

TRACKLAYING MACHINES FOR STREET RAILWAY WORK.

In the construction of street railways much complaint and trouble is often caused by the obstructions due to rails, ties and track material being piled at the sides of the road ready for use when wanted, and by the carrying of these materials across the road during tracklaying, especially on busy streets, while not infrequently some of the small material is lost or stolen.

We illustrate herewith an improvised tracklaying machine, recently used with great success in laying about 15 miles of electric railway track in Chicago. This machine was designed and used by Mr. C. E. Loss, of Chicago, the contractor for the work, to whom we are indebted for the photograph from which our illustration has been prepared. The construction and operation of the machine are so clearly shown by the illustration, that little description is necessary. The work was done on the Wentworth Ave. line of the Chicago City Ry., and was in connection with the changing of the line from horse to electric traction. The rails weighed 83 lbs. per yd. In conducting the work the rail



TRACKLAYING MACHINE FOR STREET RAILWAY WORK.

chairs were first placed and then the rails lifted and lowered into place, two men only being required for this part of the work, one man for operating the engine, and one to attach the tongs to the rail and to swing and guide it into position. The total cost of operation per 10-hour day was $5, or a saving, according to the contractor, of $15 per day over the ordinary method of lifting and placing the rails by hand. About 2,200 ft. of track would be laid complete per 10-hour day. The total cost of the machine complete was about $1,200.

Mr. D. F. Holman, of Chicago, has patented a modification of the well-known Holman tracklaying machine for ordinary steam railway construction (Eng. News, Jan. 3, 1895), which is adapted for elevated and narrow gage railways, and specially for street and electric railways. As in the ordinary machine, there is a series of tramways about 30 ft. long, 20 ins. wide, and fitted with heavy iron rollers, these tramways being attached to the sides of flat cars and supported by plank projections. The construction is much lighter than, and the method of attaching the tramways is different from, that of the ordinary construction of the machine. The rails and ties are carried on the cars and are thrown upon the tramways and rolled down to the front, where men receive and place them into position on the roadbed. The train is moved forward as fast as the rails are laid. The tie tramway is on the right-hand side of the train, and the rail tramway on the opposite side. The cars used are skeleton flat cars made for the purpose, about 30 ft. long, 6½ ft. wide and 30 ins. high, weighing about 2,200 lbs. each, with tramways attached. Four of these cars are sent out with each machine (two for rails and two for ties), and the whole outfit is shipped in sections and put together where needed. Four men can put all the parts together ready for service in one day. When the cars are loaded they can be sent to the front by steam, electric or horse power, and when tracklaying is in progress, one team will furnish all the power needed. This plan of tracklaying is claimed to save expense in various ways. A practical builder of electric railways has estimated the expense of hauling and distributing rails and ties with teams for a road 10 miles long at an average of $170 per mile, and also says that considerable loss of cash and time is sustained by damage suits brought about by horses being frightened by the piles of material scattered along streets and roadways. The machine-work is claimed to save most of the hauling expenses, to assist in avoiding damage suits, to reduce pilfering of material and tools, to do away with danger lights and to prevent damage to rails in unloading. It delivers the rails and ties with the greatest convenience possible, and leaves nothing scattered along the line. The machine and four cars will weigh about 4½ tons.

AS SEEN BY AN ENGINEER.

(Editorial Correspondence.)

Birmingham, Ala.

The last time the writer visited Birmingham was in 1891, when it was enjoying a season of comparative prosperity, 24 out of 25 of the blast furnaces in the city and its suburbs being then running. Four years before, the city had experienced a tremendous real estate boom, land was sold at fabulous prices, and town lots were laid out all over the country for 10 miles around, and in the city itself business blocks were erected in sufficient number for the needs of three times as great a population as it actually had. In 1891 the city appeared to be over-built in its business section, and rows of stores had the sign "To Rent" in their windows. To-day, the appearance is even worse. The same stores, built two or three blocks away from the business center, are still to rent; the magnificent Caldwell House, which would have been a credit to New York city, in appearance at least, and which proved an elephant to every one that had anything to do with it, either as owner or lessee, was burned down two years ago, together with a number of stores and dwellings, and the ruins remain untouched since the fire. The other hotels have worn out their carpets, and the town as a whole looks as if it had not enough money to keep itself clean. The price of land adjacent to the business section is down to half of what it was four years ago, and unless some new industries are brought into the city, it is likely to go much lower still. The manufacture of iron, however, has continued in Birmingham throughout the depression, the large companies running some of their furnaces and taking the trade, and the small ones shutting down. The present revival has started more of the furnaces of the large companies, but those owning only one furnace are still silent. From information received during a single day's stay, it appears that 16 out of the 25 furnaces of the district are now in blast, as below.

		In blast.	Out.
Tennessee C. & I. Co.,	Alice	1	1
" "	Oxmoor	.	2
" "	Ites ganer	5	.
" "	Ensley	3	1
Sloss Iron Co.,	City	1	1
" "	N. Bham	2	.
Woodward I. Co.		2	.
Thomas I. Co.		2	.
Mary Pratt Furnace		.	1
Vanderbilt Furnace		.	1
Williamson Furnace		.	1
Trussville Furnace		.	1
		16	9

Of the nine furnaces out of blast, three are being repaired and will be blown in soon—viz., one of the Oxmoor, one of the Ensley and one of the Sloss furnaces. There is no present prospect of the starting of the four plants with single furnaces. The Sloss furnace No. 1, which is now out, is being rebuilt to a size of 82 × 18 ft., with 10-ft. crucible, and a new compound blowing engine, built by the E. P. Allis Co., of Milwaukee, will be erected. It is expected that the furnace will have a capacity of 225 tons per day, which is about the largest capacity of any furnace in the district.

A great improvement in the furnace practice of the district has taken place within the past four years. The washing of coal for coke-making is now in successful operation, making a coke as low as 8% of ash, and with much less sulphur than of old, and enabling the furnaces to turn out a larger product per day and with a smaller fuel consumption. The furnaces are now being driven much more rapidly, the advantage not only being an increase in output, but a saving of fuel, and what is still more important, a better control of the quality of the iron.

A few years ago it was thought that low silicon iron could not be produced in the district unless it was high in sulphur, and therefore unsuitable for steel-making. Now, however, the silicon can be controlled, so that foundry or basic steel pig can be made containing only 1% of silicon. The most important event that has happened to the district in many years is the recent sale by the Tennessee Coal & Iron Co. to the Carnegie Steel Co. of 25,000 tons of basic pig, after the successful trial of a lot of 5,000 tons. The importance of this event can scarcely be over-estimated, for it means that it is now possible to make steel from Birmingham raw materials by the basic process direct, without the intervention of a partial Bessemerizing or desiliconizing process, which was formerly thought necessary.

During the depression the prices at which iron were sold in this district—viz., less than $7 per ton for foundry and less than $6 for forge irons—were probably the lowest prices at which pig iron was ever sold anywhere in the world at any time. The prices have now advanced about $3 per ton. These low prices, however, should never be considered as being the normal cost of producing pig in the Birmingham district. They were only made by the largest companies, which are owners of coal mines, as well as producers of pig, their coal business being larger than their iron business, and always profitable, even in dull times. The cost of coal depends to a considerable extent upon the tonnage; the selling price depends to a large extent upon the surplus production which presses upon the market. To stop the blast fur-

naces would mean surplus coal, which would depress the market price of coal, or decreased tonnage at the mines, which would increase its cost. To stop a furnace also means a certain loss of money to blow out and blow in, and to keep the organization of officers, etc., intact. It often pays better to sell iron at an actual loss than to submit to the other losses consequent upon .blowing out furnaces. During the depression also wages were very low; they have now been advanced,and freight rates have also been advanced, so that the low prices prevailing at the beginning of this year are not likely to be known again until there is another financial depression.

The position of Alabama pig iron in Northern markets is, however, assured. It will not cause the abandonment of well-located and well-equipped Northern furnaces, but will compete with the product of the Lehigh Valley furnaces in New York city, of the Ohio furnaces in Cincinnati, and of the Michigan furnaces in Chicago, the range of its distribution becoming restricted, however, as the railways advance their freight-rates to a dividend-paying basis.

The chief difficulty the Southern iron furnaces have to contend with is that, on account of the absence of a home demand, they are compelled to ship most of their iron to distant Northern points to find a market, where it has to compete with irons produced in the several Northern centers. There is a continual stream of raw iron passing northward across the Ohio River, and another stream of finished iron products, such as boilers, engines, rails, bridges, tanks and castings of all sorts passing southward. A Birmingham furnace will ship iron to Milwaukee and sell it there in competition with Michigan irons, and will buy in Milwaukee a blowing engine, made chiefly of pig iron. Thus the South is hampered by having to pay freight for a long distance both on the raw materials which it sells and the finished product which it buys. Vast amounts of capital have gone into the South in the erection of more blast furnaces than can possibly find a market for their iron, and many of these furnaces have been built on poor locations and will never be put in blast again; but there has been a singular lack of enterprise in the investment of capital in establishments to make finished iron products. The time would seem ripe for the building of a first-class general foundry and machine shop in the Birmingham district, which would make engines, machinery and castings for Southern use.

There has for many years been a great deal of talk about the erection of a steel works in Birmingham, and two or three different parties of capitalists are now said to be earnestly considering it. Steel can certainly be made in Birmingham or vicinity cheaper than at any point in the North, provided a works were erected like the Northern works, costing two million dollars or upwards, and using machinery instead of hand labor for nearly every operation; but if the steel were made, where would it find a market? It would be a hazardous business to attempt to ship billets north of the Ohio to compete with Pittsburg and Youngstown. There is not enough demand for rails in the South to warrant the erection of a rail mill, and there would be but a small demand for billets in the South. What is needed is evidently a series of finishing mills, which would take the steel works' product and put it into shapes ready for final consumption. There should be a plate mill capable of making plate in all sizes and shapes, and this product should not all be sold as plate, but should be put into the shape of boilers, tanks, bridge plates, etc. A structural mill should be built, but there are not structural finishing works in the South sufficient to use its product, so a bridge and structural works should be built alongside of the mill.

Unless a company takes hold of the steel problem with sufficient capital and enterprise to build finishing works to use its raw product, there is grave doubt of the ultimate success of any steel works in the South. The existing iron works cannot do it, for they are already overburdened with bonded debt, but it would appear that if Northern capital in sufficient amount were to be obtained to build both steel and finishing works for cash and not on bonds, the enterprise could not fail to be a spendid success. Moreover, if a steel works is built, it must not depend upon purchasing basic pig from the existing furnaces, but must control its own supplies of ore and fuel. As the best ore and coal lands are all taken up by the present companies, the best policy to adopt would seem to be a consolidation of the steel company with one of the best located of the existing blast furnace companies, or a purchase or lease of one of these plants with its coal and ore supply.

Bessemer, Ala.

The town of Bessemer (it was called a city, I believe, in the days of the boom) is about 12 miles from Birmingham. It was laid out about ten years ago, when Birmingham's phenomenal growth was the talk of the nation. Streets were opened and graded over a territory about two miles square, and houses were built here and there, with wide intervals between them, over all of this tract. With the collapse of the boom the erection of buildings stopped, and the town has the same scattered and half-finished appearance that it had four years ago. The town, however, had a more substantial basis for its existence than was the case with most of the mushroom towns of that day, for Bessemer is the site of three blast furnace plants belonging to the Tennessee Coal and Iron Co., and containing five furnaces in all, and also contains the extensive cast iron pipe works of the Howard-Harrison Iron Co. The pipe works is one of the largest and most complete in the world, and has the advantage of being close to the supply of the cheapest pig iron in the United States. It was the lowest bidder on a large contract for pipe to go to Japan, in competition with European makers, but it did not obtain the contract, which went to a Scotch firm, since the latter agreed to the condition of delivering the pipe in Japan subject to inspection there, while the Harrison works would not depart from the American custom of having the pipe inspected at the works. The works are not essentially different in character from other large pipe works. The pipes are cast vertically, standing in large circular pits, which are served by steam-driven jib cranes. Electric motors are now being substituted for the steam engines in these cranes. In the electric-driven crane there are less machinery to get out of order, less noise, and probably a considerable saving of steam, since the little engines used on cranes are exceedingly wasteful. An important improvement in these works is the system of drying the cores. They are dried by hot air, which is blown by a Root blower through a cast iron hot blast stove similar to the old style stoves used at blast furnaces before the fire brick stove came in vogue. The hot blast stove is heated by the waste heat from the coke ovens. It is intended also to use the hot blast for blowing the cupolas, and no doubt a considerable saving of coke will be thereby effected.

Coal Washing and Utilizing Waste Heat from Coke Ovens.—At the Howard-Harrison pipe works may be seen two novelties in connection with the manufacture of coke which will probably soon be generally adopted in Southern coke works—viz., the washing of the coal before coking, in order to remove a portion of the ash and sulphur, and the carrying of the hot gases from the coke ovens through flues to the boilers for raising steam for the works, and to the hot blast stoves for heating the air, as mentioned above. Many unsuccessful attempts have been made in the past to reduce the ash in Southern coals by means of washing, but the system now adopted, an English system known as the Robinson, improved by Mr. Erskine Ramsay, mining engineer of the Tennessee Coal & Iron Co., seems to be entirely successful, as it has now been adopted by several concerns in the district. A detailed description of this coal washer is deferred to a later issue. The washed coal is coked in 100 coke ovens, disposed in two rows. Underground brick flues laid behind the ovens convey the waste gases to a pair of Babcock & Wilcox boilers and to a pair of hot blast stoves. Enough air apparently enters the flue through the small openings in the top of the ovens to burn the gases in the flue, so that no air for combustion is admitted at the boilers and stoves.

The Ensley Blast Furnaces.

The blast furnace plant at Ensley, belonging to the Tennessee Coal & Iron Co., is by far the finest in Alabama. It consists of four furnaces, each 20×80 ft., with four firebrick stoves to each furnace. Three of the four furnaces are now in blast, and the fourth is undergoing repairs. The furnaces have recently greatly increased their product, an output of 275 tons in one day having been made in one of the furnaces. The eight blowing engines of the plant are now all in use to blow the three furnaces, and additional engines have been ordered to increase the blowing capacity up to the new requirements of the four furnaces. The furnaces at Ensley were kept running throughout the business depression, and presumably did not lose money for their proprietors, even when pig iron was selling below $6 per ton.

The Maryland Steel Co., Sparrow's Point, Md.

After leaving Birmingham, your correspondent went to Atlanta to attend the meeting of the American Institute of Mining Engineers, an account of which was given in the last issue of Engineering News, and to visit the Exposition. Returning to Washington by the special train which carried homeward those in attendance at the convention, he went thence to Sparrow's Point, about 10 miles from Baltimore, to visit the works of the Maryland Steel Co. The works consist of four blast furnaces, 85×22 ft., with a Bessemer works containing two 20-ton converters, a blooming mill, a rail train, together with extensive machine shops, a structural shop for building bridges and other structures, and a shipbuilding plant. The first blow of steel was made in these works in August, 1891. They were built at this location, on tidewater, with the view of receiving their supply of ore from Cuba and their coke from either Pocahontas, Va., or Connellsville, Pa. At the time they were built, with the prices then prevailing for Lake Superior ores and the prospect of getting a sufficient supply of ores from Cuba, the location appeared to be the best in the country, but a series of unforeseen events shortly took place which proved disastrous to the company. The works being principally adapted to putting steel into the forms of rails, the decreasing demand for rails after 1891 was most unfortunate. Then followed the general depression in business, and the failure of the Pennsylvania Steel Co., whose owners were also owners of the Maryland Steel Co. For about three years the works were in the hands of a receiver, but a reorganization has been effected, and the works are again in control of the company. The war in Cuba has stopped the supply of Cuban ore, but a supply has been procured from Spain. Three vessels are now unloading ore at the docks, and the blast furnaces and rail mill will soon be started. An important part of the business of the company will in the near future be its general machine shop branch. The shop is fitted with a complete assortment of heavy tools, and will be able to undertake the construction of the heaviest kind of machinery. Contracts are now being executed for Corliss engines, blowing engines, and similar work, and the control of its own raw material which the company has should enable it to handle this class of work to great advantage.

NOTES FROM RECENT WATER-WORKS REPORTS.

Boston.—The water supply for a number of islands in Boston Harbor on which city institutions are located is maintained at much trouble and expense. The original cost of laying the present submerged pipes to Moon, Thompson's, Long, Rainsford and Gallop's islands, and the change from low to high service, was $66,025. The repairs on the system up to Feb. 1, 1895, aggregate $12,892. If we correctly understand the last report of the Boston Water Board, this system was put in use on Aug. 21, 1889. Two submerged lines of 3-in. wrought iron pipe are already so badly corroded as to make it difficult to maintain the supply to the islands they serve, even in the summer time. With this in view, the Commissioners of Public Institutions constructed a 1,300,000-gallon storage reservoir on Long Island in 1894, and the construction of storage reservoirs on two other

islands has been recommended. Aside from corrosion, trouble is experienced from freezing and bursting of the pipe at the shore ends, the storms washing away the covering and endangering the pipe at times of minimum circulation. The report states that it was proposed to lay new lines of pipe this season, and to adopt some means, if possible, to prevent freezing.

Another interesting portion of the above report is the contract between the city of Boston and the town of Marlboro, allowing the latter to change certain roads in the construction of the storage reservoir known as No. 5. The length of roads abandoned or changed in grade and of new roads built by Boston is not stated. The city agreed to build fences on all new roads and all roads with changed grades. The fences are to be field-stone walls where practicable; where impracticable iron fences must be built, not less than 4 ft. high, made of two iron gas-pipe rails not less than 2½ ins. in diameter, fixed in iron posts not less than 3 ins. in diameter, the posts securely set in stone bases. The city agreed to pay for the services of policemen during the construction of the reservoir at wages not over $2.50 a day, and also to meet the expense of a lock-up.

The city also agreed to pay the town $50,000, "being the estimated cost to said town of building other highways, and the extra cost of repairing the ways hereinbefore mentioned, when raised or altered by said city." The length of road involved is not stated.

Mr. Desmond FitzGerald, M. Am. Soc. C. E., Resident Engineer and Superintendent of the Western Division of the Boston Water-Works, reviews the phenomena of stagnation of water stored in deep ponds in his section of the above report. The review is based on extended temperature observations and biological examinations carried on during the past five years, and is an excellent exposition of the whole subject, throwing much light upon the tastes and odors imparted to stored waters during certain seasons of the year by animal and vegetable growths, the relation of temperatures to the same, and incidentally showing the value of stripping reservoir sites of organic matter before filling. Accompanying this discussion is a detailed description of the diatom (plant) and infusoria (animal) growths in the Boston reservoirs, prepared by Mr. G. C. Whipple, assistant in charge of the laboratory.

Under the direction of Mr. FitzGerald experiments were made during the year by Mr. W. E. Foss, C. E., to determine the effect of sunlight on the decolorization of water. It was concluded that the color of Boston tap water can be entirely removed by long-continued exposure to the sun; that the process is influenced but slightly, if at all, by temperature, and that the reduction of color for 100 hours of sunlight is the same at all seasons of the year; also that the reduction varies almost directly with the amount of color present in the water.

Lawrence, Mass.—The folly of allowing the waste of water which had been filtered at considerable expense has led to the adoption of the meter system at Lawrence, Mass., on all new services where the fixture rates would be over $5 a year, and to measures designed to increase the use of meters on old services.

Lowell, Mass.—Engineers who have charge of water-works in which a suction main is connected with a gang of driven wells know that trouble is sometimes experienced with air drawn into the pipe system. A method employed to obviate this difficulty is thus described by Mr. Geo. Bowers, City Engineer of Lowell, Mass., where 45 driven wells were connected with one pumping plant:

An air separator, designed by B. O. Gage, of Boston, was inserted in the suction main April 7, just outside the pumping station. The separator is circular, 7 ft. in height, and made of boiler iron; it is dome shaped, 28 ins. high at the side, and 44 ins. in the center, and contains three dams. The water coming from the wells passes over the first dam, under the second, over the third, and then passes into the pipe which runs to the pumps. An air pump was connected with the top of the separator, to take away the air which was liberated as the water flowed over the dams. But this, a Worthington duplex 6×8½×6-in. wet vacumn pump, was soon found to be too small to take care of the large amount or air received, and a larger pump, 7½×10¼×10 ins., was purchased and put at work, both being kept running to their utmost capacity. After two months' trial of the separator, the middle dam was removed, with good results. As the plant is composed of 5,806 ft. of suction pipe and branches, there are a great number of joints to be kept air tight, and it required constant care. A man goes over the line every morning with a pail of asphaltum paint, and if there are any leaks, he repairs them. This air difficulty was referred to in last year's report, and is still a cause of great trouble. I have received letters from different parts of the country inquiring how to deal with the air question, so we are not the only people with this problem on our hands.

New Bedford, Mass.—The value of a water-waste inspection at New Bedford is shown by Mr. R. C. P. Coggeshall, Superintendent, in his report for 1894. The inspections were made between 10 p. m. and 4 a. m., by means of steel rods touching the curb stop of each water taker. If an application of the ear to the rod resulted in the sound of running water, the location of the house was noted, and a day inspector made an examination as soon as possible. The inspection was carried on for 36 nights, and cost $262. Leaks to the number of 989 were discovered and stopped, of which 578 were defective water-closets. The consumption for October and November, after inspection, showed a reduction of 648,888 gallons, as compared with these months for the previous year.

Waltham, Mass.—The last report of the water board contains a first-floor plan and a perspective view of a new combined workshop and stable for the water department. The building is of brick, 40 × 70 ft., two stories in height, with a basement. The workshop is in the basement and supplied with all necessary tools. The first floor is constructed of expanded metal and cement, resting on steel arched channels and I-beams. In the first story is an office, a bath room, with tub, basin and water-closet, a carriage room and stalls for six horses. The second story is for hay, grain and general storage.

Webster, Mass.—The water-works of this town were for years remarkable chiefly from the name of the source of supply, Lake Chaubunagungamaug. Recently the town built works, the former system having been a private one. Water pumped directly from a lake with such a name being no longer tolerable under municipal ownership, a large well has been sunk some 300 ft. from the lake. The well, pumping station, stand-pipe and other parts of the system were built with Mr. F. L. Fuller, M. Am. Soc. C. E., as engineer, and are described in the first annual report of the Webster Water Commissioners.

Winchester, Mass.—The report of the Water Board for the year 1894 shows throughout its pages the mind and work of its engineer-member and Secretary, Mr. John R. Freeman, M. Am. Soc. C. E. It is evident from the report that much work was done during the year to put the water department on a sound business and engineering basis, and that Mr. Freeman's suggestions and efforts were seconded by the other two members of the board, Mr. D. N. Skillings, Chairman, and Mr. Lewis Parkhurst.

When the Winchester works were built, in 1874, cast iron pipe delivered in that vicinity cost $52.50 per ton, against $22.70 f. o. b. in 1894. A considerable amount of combined cement and wrought iron was laid, being much cheaper then, and has been added to from time to time. It was decided to change to cast iron in 1894. Some of the reasons for this change were set forth at the time by Mr. Freeman, and are repeated in the report. They may be summarized as follows:

(1) Cast iron pipe can (in 1894) be laid cheaper than cement-lined. Long lines of 6-in. pipe, with easy digging, cost about 55 to 60 cts., laid, for cast iron, and 65 to 70 cts. for cement, hydrants and valves not being included in either case.

(2) Cast iron pipe is much stronger, its computed bursting strength being ten times as great as that of cement-lined wrought iron.

(3) The life of cast iron pipe is much longer than that of cement-lined. The relative thickness of metal, as used in Winchester, is 1-22 in. for sheet iron, and, as proposed, is ½ in. for cast iron. If the iron be exposed by cracking of the cement, it will soon rust through. Imperfect work is a great difficulty with cement-lined pipe, as 1 sq. in. of poor cement covering per 100 lin. ft. of pipe might spoil a whole line. Winchester has been fortunate in its experience with cement-lined pipe, probably owing to unusually favorable conditions and to good workmanship, but for all this the average leaks per year in this pipe in Winchester are more than those in cast iron for all Nashua and Lowell. A number of examples are cited of the failure of cement-lined pipe in other cities and of its abandonment. It has sometimes been held directly responsible for large fire losses.

(4) Cement-lined pipe is often ruined by lightning.

(5) Cast iron pipe can be safely laid and repaired in freezing weather, while cement-lined is endangered by frost, if exposed before setting.

(6) Cast iron pipe is more free from damage in handling.

As a great advantage over cast iron pipe Mr. Freeman cites the freedom of cement-lined pipe from the formation of tubercles, which sometimes reduce the diameter of cast iron pipe.

The report states that while the laying of cement-lined street mains was discontinued, this material was retained for services; but the metal portion is made from ⅛-in. wrought iron, lap-welded, thus being nearly three times as thick as the metal in the street mains and without longitudinal rivets.

During 1894 the water board enlisted the sympathies, and to some extent the financial aid, of both the sewer and street commissions, and made good progress in a complete survey of the streets of the town, based on careful triangulations.

Providence, R. I.—The filtration experiments, begun here in 1893 and completed in 1894, are very briefly summarized as to the results from the Morrison-Jewell mechanical filter in the last report of the City Engineer, Mr. J. Herbert Shedd, M. Am. Soc. C. E. The experiments were conducted under the immediate direction of Mr. Edmund B. Weston, M. Am. Soc. C. E., Assistant Engineer in Charge of the Water Department. The average run at 128,000,000 gallons an hour before the clogging of the sand increased the head or water on the filter to 4 ft. was 16.7 hours. The following results were obtained while filtering at an average rate of 128,000,000 gallons an hour, and using 0.6 grain of basic sulphate of alumina per gallon of applied water:

	Per cent.
Water bacteria removed	98.6
Applied "bacillus prodigiosus" removed	99.8
Albuminoid ammonia removed	70.0
Ready-formed ammonia removed	91.0
Color removed (during the day)	78.0
Color removed (during the night)	66.0
Per cent. of the total amount of water filtered during a run, necessary to wash the filter bed	4.9
Per cent. of the total amount of water filtered during a run, necessary to waste after starting the filter	2.9
Total waste	7.8

New London, Conn.—Temporary small size street mains from ¾ to 1½ ins. in diameter were in use here in September, 1895, to the extent of 15,321 ft. This length was divided among the different sizes as follows: ¾-in. 1,057 ft. on 14 streets; 1-in., 11,877 ft. on 54 streets; 1¼-in., 176 ft. on three streets; 1½-in., 2,211 ft. on five streets.

Brooklyn, N. Y.—A minimum size of 8 ins. for water distribution pipe is recommended in the last report of the Department of City Works by Mr. Peter Milne, Water Purveyor. Mr. Milne states that the relative cost of 8 and 6-in. pipe is as 5 to 4; the relative capacities as 64 to 36, and the frictional resistance as 25 to 19.

Little Falls, N. Y.—Some interesting facts regarding the salt-glazed vitrified stoneware pipe used in the supply conduit of these works is presented by Mr. Stephen Babcock, Chief Engineer, in the report of the Water Commissioners for 1894. Part of the trenching for the vitrified pipe was through sandstone full of vertical and horizontal seams and fissures. To bring the pipe to grade, it was bedded at points in earth and spall filling. The trench has since acted as a drain for the adjacent territory, and the filling beneath the pipe has been washed into the fissures. This has resulted in settlements, which have started joints and in some cases broken the vitrified pipe. It was decided in 1894 to open the trenches where through rock, bed the pipe to half its depth in cement mortar and place a collar of the same material around each joint. About 7,800 ft., in nine different sections, were so treated. The cost of this work is not given. The vitrified pipe sections of this conduit aggregate 5.63 miles in length, and range from 20 to 12 ins. in diameter, according to grade. Cast iron was used for 3.09 miles of the conduit, under considerable pressure. When built the vitrified

pipe laid cost about one-half as much as cast iron. The actual saving in cost by using vitrified pipe was $61,324, which, at 3¼%, the approximate average rate of interest on the bonds, effected a saving of about $2,000 a year in fixed charges, or a total of about $16,000 thus far. The yearly repairs on the whole conduit line, and some work of cleaning out a brook and reservoir in addition, have been as follows since the conduit was put in operation: 1889, $1,392; 1890, $81; 1891, $44; 1892, $185; 1893, $491; 1894, $5,790; total, $7,983. This conduit was described in our issue of April 28, 1888.

Staten Island, N. Y.—Water companies and officials of works owned by municipalities are now liable to have their supplies and acts scrutinized from a new standpoint. The Good Government Club of Richmond County, N. Y., through its health committee, recently took upon itself the investigation of the water supply of New Brighton and Port Richmond, which villages are served by the Staten Island Water Supply Co. To assist in this task, Mr. L. L. Tribus, Assoc. M. Am.Soc. C.E., 84 Warren St., New York city, and Prof. Peter T. Austen, of Brooklyn, were engaged to report, respectively, on the engineering and chemical questions involved. Mr. Tribus made a careful study of the plant, even including pressure tests at 20 fire hydrants, and Professor Austen made a couple of chemical analyses. The club published a full report on the subject, including a summary of conclusions, suggestions and recommendations on the quality of the supply, its quantity and the character of the service, to which the interested reader is referred for further information.

Richmond, Va.—A special committee of the city council has recently reported in favor of metering all water services rather than increasing the capacity of the pumping plant and distributing system. Mr. E. T. D. Myers was chairman of this committee, and among its other members were the Water-Works Superintendent and City Engineer, Messrs. C. E. Bolling and W. E. Cutshaw, respectively. A minority report was submitted by Mr. Reuben Shirreffs, in which he set forth at some length his reasons against introducing meters and in favor of enlarging the plant. Both reports have been printed.

Detroit, Mich.—The abandonment of the standpipe at the pumping station is recommended by Mr. Uriah Gould, Engineer, in the reports of the Detroit Water Board for both 1893 and 1894. In the former report Mr. Gould stated:

> It is very frequently necessary to raise the pressure higher than our stand-pipe, and, as the stand-pipe does not relieve the engines, I would recommend connecting the 30-in. main thereto, through a weighted relief valve, direct to the waste, and discontinue the use of the stand-pipe altogether.

In the report for 1894 this recommendation is repeated, with the following comments:

> I think it would be perfectly safe to shut it off, with what relief we now have on our engines; but, certainly, the higher the pressure added each year, the greater will be the strain on our pumps and connections. I consider, however, the stand-pipe is not effective for the purpose of taking the pulsation off the pumps, or a guard against a water ram. Heavy bodies move slowly. That being the case, it is certainly no use for either purpose. The cause of the water ram, or hammer, which has been mentioned in former reports, is not quite clear to me, for not having any valves or gates of sufficient size that could be closed quickly, I can see but one way to account for it, which is by air collecting in the pipes at some high part of the system.

The stand-pipe in question is 5 ft. in diameter at the base, diminishing to 2½ ft. at the top, and is 132 ft. high.

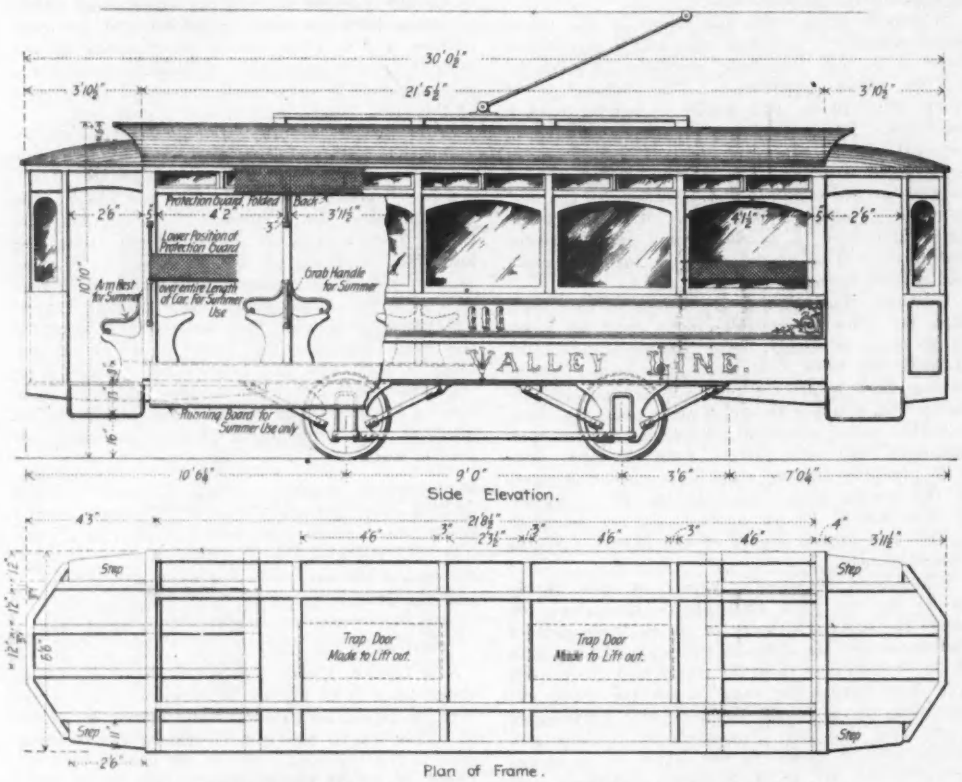
Grand Rapids, Mich.—The question of allowing a yearly sum for water furnished by works under city ownership for general public purposes is one that strikes home to almost every water department. The last report of the Board of Public Works of Grand Rapids, Mich., has this to say on the subject:

> The water-works does not receive any income from, or credit for, water supplied to fire hydrants, public fountains, for its use in parks or city cemeteries, nor for that used in the flushing of sewers or washing of streets. A reasonable allowance for such purposes alone would more than pay the interest on bonded indebtedness of the works.

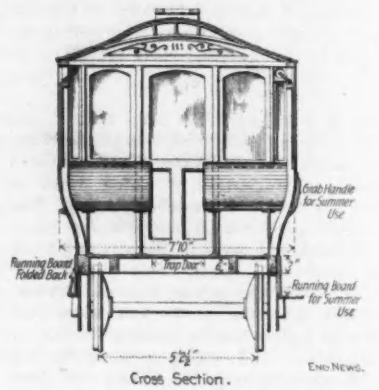
At first thought this may appear to be a mere matter of bookkeeping, but a moment's reflection will show that money must be raised by general taxation for this purpose, or else private water consumers must pay for water used for public purposes when settling their bills for domestic consumption. If money is raised in the general tax levy to help support the water-works, why not let it stand for what it is, payment for public service? With a fair amount thus provided, private rates may be adjusted to make up the balance needed to run the works, pay interest, depreciation and redeem the bonds.

Saginaw, Mich.—The Water Board, in its report for 1894-5, states that it has sent a bill for $1,023 to the local Street Railway Co. for the cost of replacing lead service pipes rendered unsafe by electrolysis. The Board uncovered all the services in a street on which a new pavement was to be put down, and found that some services "were not perceptibly injured; others showed unmistakable signs of the work of electricity in from one to two years' service, while a large number were eaten away to a point where it was deemed unsafe, and they were replaced with new lead" at the expense named above.

St. John, N. B.—Some wrought iron and cement pipe in use here is stated in the last report of the Department of Public Works to be in such bad condition that the direct supply is kept shut off at ordinary times, and the mains are fed through a circuitous system of pipes varying in diameter from 8 to 4 ins." In case of fire direct pressure is put on, and immediately afterwards a force of workmen is put on to repair leaks. In many places the sheet iron is rusted through, and only the cement holds the water. The estimated cost of replacing these cement mains with cast iron is $30,000, and this applies to the low districts only. On the higher levels, where the pressure is less and the soil more favorable, the report states that the cement mains will probably last for some time yet. The weak mains are in made lands, adjoining the harbor, and some of the trouble there is due to settlements.



HENRY'S CONVERTIBLE CAR FOR SUMMER AND WINTER SERVICE.
Federal St. & Pleasant Valley Passenger Ry., Pittsburg, Pa.



COMBINATION SUMMER AND WINTER CAR FOR STREET RAILWAYS.

On nearly every street railway the number of cars required is considerably beyond the number actually needed for the traffic, owing to the necessity of having special open cars for summer use, which remain idle for a large part of the year. Several styles of combination or convertible cars have been brought out, but have failed to meet with general favor. We illustrate herewith a design for a combination car patented by Mr. D. F. Henry, President of the Federal St. & Pleasant Valley Passenger Ry. Co., of Pittsburg, Pa., who informs us that 20 of these cars have been ordered by his company from the St. Louis Car Co., of St. Louis, Mo. The cars have transverse seats, with a central aisle for winter service, while for summer service the spaces are filled in by movable sections, the seats being made accessible by running boards at the sides. The summer arrangement gives seating capacity for 60 passengers, and the winter arrangement for 40 passengers. Folding side guards are used during the summer on the side of the car next toward the other track, and these, as well as the running boards, are folded back when the car is fitted as a closed or box car. In altering the car for summer service, the sashes are lifted out and 20 screws taken out of each side, which allows the sides to be removed; the seat sections are then put in and the running boards bolted on, all of which can be done in two hours, according to Mr. Henry, to whom we are indebted for blueprints and specifications of the cars.

The cars are 22 ft. 1 in. long over the body, and 30 ft. ½ in. long over all, with vestibuled platforms 3 ft. 11¾ ins. long, having folding gates at the sides. The width is 6 ft. 7 ins. over the sills, including the panels, and 7 ft. 10 ins. over the belt rails. The height from floor to eaves of roof is 6 ft. 11 ins., and from rail to top of roof

WEATHER TABLE FOR SEPTEMBER, 1895. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature, (Deg. Fahr.) Average.	Max.	Min.	Range.	Wind. Velocity in miles per hour. Average.	Max.	Direction at time of max. velocity.	Precipitation—rain or melted snow—inches. Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	57.8	90	26	64	7.7	35	S	2.60	1.08	5
	Portland, Me.	61.8	93	42	51	6.8	26	NW	1.79	0.87	9
	New York, N. Y.	69.7	97	44	53	11.3	48	S	0.95	0.58	8
	Pittsburg, Pa.	71.0	94	42	52	6.0	24	SW	1.83	1.12	9
	Chicago, Ill	68.6	92	36	56	18.7	53	S	0.89	0.58	7
	Omaha, Neb.	71.2	102	34	68	9.5	36	S	0.90	0.50	5
	St. Paul, Minn.	65.1	96	33	63	8.4	55	SE	4.75	3.19	10
	Duluth, Minn	57.6	85	36	49	10.7	45	NE	5.96	2.21	15
	Bismarck, N. Dak	59.2	96	24	72	11.3	40	NW	0.67	0.62	4
	Average	64.7	94	35	59	10.0	39		2.26	1.19	8
Southern Cities.	Washington, D. C.	72.4	98	45	53	5.4	28	NW	1.11	0.59	5
	Louisville, Ky.	74.0	96	40	56	6.8	36	SW	0.41	0.34	3
	St. Louis, Mo	74.0	95	42	53	10.2	41	NW	2.01	0.66	4
	Savannah, Ga	78.2	94	62	32	6.1	28	NW	2.72	0.89	9
	Kansas City, Mo	73.2	96	37	59	10.5	36	SW	1.43	0.58	5
	Jacksonville, Fla.	79.1	94	64	30	6.2	34	W	4.66	1.70	9
	Chattanooga, Tenn.	75.3	93	47	46	4.8	32	S	1.00	0.44	5
	New Orleans, La.	81.7	94	57	37	6.4	32	NE	1.97	1.09	11
	Memphis, Tenn.	77.8	96	45	51	7.7	34	NW	0.73	0.37	7
	Palestine, Tex.	80.5	100	48	52	6.0	27	SE	1.05	0.51	5
	Average	76.6	96	49	47	7.0	33		1.71	0.72	6
Western Cities.	Helena, Mont.	52.6	83	26	59	8.3	38	W	0.57	0.17	6
	Port Angeles, Wash	50.7	62	33	29	5.3	32	W	0.35	0.15	8
	San Francisco, Cal	60.7	89	51	38	11.5	35	W	0.77	0.62	4
	Salt Lake City, Utah	63.8	90	29	61	7.1	38	S	0.95	0.75	3
	Santa Fe, N. Mex	53.6	84	33	51	6.3	34	E	0.09	0.08	3
	Denver, Colo.	65.6	96	27	69	6.8	32	NW	0.98	0.96	3
	Yuma, Ariz.	84.2	107	58	49	6.1	28	N	T	T	0
	Average	63.0	88	37	51	7.3	24		0.83	0.39	4

is 10 ft. 10 ins. A monitor roof has been adopted instead of the round roof shown on the drawings. The roof is covered with No. 6 cotton duck, laid on white lead and painted with three coats. The sills are of oak, the upper frame of ash, and the interior finish of ash and cherry, with hardware fittings of bronze. All joints are laid in white lead and strengthened with iron rods, strap bolts, angle irons, etc. Large plate glass windows are used, fitted with spring roller curtains, and the end and lower door windows have drop sashes for summer use. Spring seats are used, covered with rattan and having Wilton carpet covering for winter use. The side guards for summer are of brass. The car equipment includes radiating drawbars, 16-in. brass brake wheels, signals bells, electric call bells, alarm gongs, electric lamps and heaters, reversible signs on dashboards and sides, four sandboxes and movable floor mats of ash strips. The side panels, which are movable, are of ½-in. veneer, though originally specified to be of No. 14 steel. The exterior is painted Pullman color, with nickel leaf lettering and gold scrollwork. The cars are carried on four wheels, with a wheelbase of 9 ft.

PAINTED OR PLANISHED IRON JACKETS FOR LOCOMOTIVE BOILERS.*

By E. E. Russell Tratman, Assoc. M. Am. Soc. C. E.

The use of planished iron for locomotive boiler jackets has been almost universal in this country until within the past few years, but many roads are now making experimental trials of common iron or steel painted. It has very frequently been assumed that painted jackets would be the more economical, and European practice in this respect is commonly cited as an example of this class of work, but while they may be made more economical than planished iron jackets, yet, on the other hand, the work of painting may be so elaborate as to make the finished jacket more expensive, European practice (and especially English practice) is by no means to be recommended, as the variety of colors used, the amount of striping and decoration, and the elaborate finish preclude any idea of economy. A planished iron jacket is necessarily expensive in first cost, it requires considerable care and cleaning; the thin metal soon gets dented and battered, the dripping from the roundhouse roof will eat away the enamel, and when the surface begins to wear in bright spots and to rust, the entire jacket soon looks shabby and must be renewed. A much cheaper quality of iron is used for a painted jacket, and if economy is the first consideration the painting may be cheaply done and yet be of fairly good appearance, durable, and costing little for maintenance. Since the common iron or steel is as efficient as the more expensive planished iron, as far as clothing purposes are concerned, it would seem to be true economy to use the former, and then to expend as much paint and labor upon it as is consistent with the financial condition of the road and the standard of appearance which is to be observed. The painted jacket should last as long as the boiler, and the expense for maintenance is limited to occasional painting, which may be more or less frequent, according to the circumstances of different roads. The Pennsylvania R. R. has adopted painted jackets as the standard for both passenger and freight engines, the Chicago, Burlington & Quincy R. R. abandoned the planished iron some years ago, and several railways are painting the planished iron jackets instead of renewing them when they become shabby.

* Abstract of a paper read before the New York Railroad Club, Oct. 17.

An electrical pumping plant has been built for the Fulton Woolen Mills, of Oswego Falls, N. Y., the pumps being two 8 × 12-in. triplex, manufactured by the Goulds Manufacturing Co., of the same city. The pumps have a capacity of about 900,000 gallons a day when operated at 40 revs. per min. They are driven by a Westinghouse motor, running at 1,300 revs. per min., which is belted to a countershaft, to which the pump shafts are connected by means of two friction clutches, rendering it possible to operate the pumps singly or in pairs, and to start or stop them without the necessity of stopping the motor. The current for operating the motor is supplied from the dynamo which is used to light the mill. The pump house, which is a brick building 25 × 35 ft., is situated one-half mile from the mill on the shore of Lake Neahtawanta, from which the water is taken.

BOOK REVIEWS.

AMERICAN STEAM VESSELS.—By Samuel Ward Stanton. New York: Smith & Stanton. Cloth; oblong; 12 × 8¼ ins.; pp. 499; illustrated; $5.

This book has been compiled for the purpose of bringing together illustrations and descriptions of all the various types of American steam vessels, from the beginning of their successful construction down to the present day. It comprises river, sound and lake steamers, ferryboats, tugs, excursion steamers, yachts, sea-going steamers and naval steamers of various types, and, with some historical steamers, includes about 300 vessels. In nearly every case there is a side elevation of the vessel on one page, and a picture or general view of the steamer on the opposite page, the latter page having also a brief description of the vessel in fanciful type, and a decorative margin. The illustrations are all reproductions of pen drawings, and are printed in various colored inks. The illustrations are arranged in order of date, commencing with the "Clermont" of Robert Fulton, 1807, and ending with the "St. Louis," transatlantic liner, 1895, but it is somewhat surprising to find no mention of the four transatlantic liners built in 1872 for the American Line, although several of the old-time sidewheel steamers are shown. There is no general discussion of the subject, and no statistics are given, but simply the views and brief general descriptions of about 300 individual vessels.

PRACTICAL APPLICATION OF THE INDICATOR with Reference to the Adjustment of Valve Gear on All Styles of Engines. By Lewis M. Ellison, 25 W. Lake St., Chicago. Published by the author. 8vo; cloth; pp. 197; 90 illustrations.

This work is dedicated by the author to his "friend the working engineer." He states that he has found a general complaint that most of the works on the indicator now published are not sufficiently definite for the beginner, and he has "endeavored to use only such wording as would be readily understood by all, and to avoid all intricate formulas which tend to confuse and mislead the reader." We think he has not succeeded in his effort to make the wording easily understood, and while he no doubt is an able expert with the indicator, he is far from being a master in the art of writing the English language. Many of his sentences are so involved that they need to be read twice in order to be understood, and they frequently violate the rules of grammar and of punctuation. Numerous errors of statement concerning steam-engine theory and practice are also contained in the book, which, while not serious, are blemishes that diminish to some extent its value. The following is an extract in which these defects appear:

It takes an additional amount of steam on the admission side of the piston to form compression; but if there were no loss from condensation during compression and expansion, and the steam be expanded to the same pressure as that when the exhaust valves are closed, there would be no loss from compression. Condensation, however, exists which causes loss of economy from compression; yet if the clearance space be filled with live steam, whose temperature is greater than that of the cylinder walls, etc., it would also result in loss of economy from condensation; therefore to obtain the greatest economy direct from compression, it should be at a temperature that does not exceed the temperature of the cylinder walls, etc. Cylinder condensation has led some engine builders, as well as engineers, to believe that a steam-jacketed cylinder is more economical than an unjacketed one, but this is a mistaken idea, and whenever tests have favored the steam-jacketed cylinder the conditions have been unfavorable for the unjacketed cylinder.

The work contains the usual instructions for use of an indicator, but is defective in describing too few of the various kinds of reducing motion that are in general use and in not giving explicit directions for the testing of indicators. A large portion of the book is devoted to discussion of errors of valve setting and of engine construction which are discovered by the indicator. Directions for setting the valves of Corliss, riding cut-off, and single-valve engines are also given. These portions of the book are very good, and to some extent counterbalance the imperfections we have noted. On the whole, the book is a fairly good one, and it may be recommended to those "working engineers" who have not already a sufficient number of older treatises on the indicator. Every steam engineer should have more than one such treatise, in order to be able to compare the views of different authors, and the one before us may be included in the list of those worth having if the user is careful not to place too implicit reliance on such statements as that concerning steam jacketing quoted above.

THE PRODUCTION OF COAL IN 1894.—By Edward Wheeler Parker. Extract from the 16th Annual Report of the Director of the U. S. Geological Survey. Part IV.—Mineral Resources of the United States for the Calendar Year 1894. Government Printing Office, Washington, D. C. 4to; 224 pp.; no illustrations.

The approximate areas of anthracite coal fields in the United States is 995 sq. miles; or 500 sq. miles in New England, 480 sq. miles in Pennsylvania, and 15 sq. miles in New Mexico. But while some coal has been mined in New England, in past years, the classification as anthracite is erroneous. The original beds have been metamorphosed into graphitic coal, and the product requires such a high degree of heat for combustion that its mining for fuel purposes has been abandoned. The Pennsylvania fields, on the other hand, produced, in 1894, 46,358,144 long tons of anthracite coal, valued at $78,488,063; a decrease of 1,827,162 tons from the output of 1893, while the average marketing price declined from $1.94 to $1.85 per long ton. Since 1820, when the Pennsylvania fields were first opened, a total of 906,013,403 long tons of coal have been shipped to market, and the amount consumed at the collieries and in the local trade would add not less than 10% to this total. To the 1894 output of anthracite should be added 71,550 short tons mined in Colorado and New Mexico.

The production of bituminous coal, in 1894, and including lignite, brown coal, and small scattering lots of anthracite, was 118,820,405 short tons, valued at $107,653,501. This is a decrease of 9,564,826 short tons as compared with 1893, and a decrease in value of 12%. Much of this falling off in production was due to the memorable strikes of 1894; and Mr. Parker, in showing the loss to the mine workers, says that while 230,365 men worked an average of 204 days in 1893, 244,603 men worked an average of 171 days in 1894. This is equivalent to a loss of one day by 5,167,357 men, or the compulsory idleness of 17,224 men for a year of 300 full working days. The table showing the production of bituminous coal by states credits Pennsylvania with 39,912,463 tons; Illinois with 17,113,576 tons, and Ohio and West Virginia with nearly 12,000,000 tons each. The remaining amounts come from 25 states and territories, from California to Virginia. The report gives the total number of employees in the coal mines of the United States for the last five years, and the average time made by each in the year. The record for 1894 is 376,206 employees, and 178 days of active work. In 1892 318,204 men made an average of 216 days. The average price of coal at the mines in 1894 was $0.91 per ton for bituminous and $1.52 per ton for Pennsylvania

anthracite. The world's production of coal at the present time is approximately 572,501,667 short tons, in which aggregate Great Britain is credited with 210,870,828 tons, against 170,741,526 for the United States. In 1893 Germany mined 93,934,409 tons; France, 28,276,898 tons; Austria, 29,266,821 tons, and Belgium, 21,398,104 tons. The remaining smaller amounts, the largest of which is 7,621,969 tons from Russia, come from the scattered coal fields of the world. The product of the United States equals about 30% of the world's product, while Great Britain's product is about 37%.

The report then takes up a review of the coal trade for 1894, and treats of the production in detail and by coal trade centers of distribution. Included in this are very full statistics of labor, production and values, a full directory of anthracite coal mines in Pennsylvania, etc.

"DER NORD-OSTSEE-KANAL."—Festschrift by Carl Loewe, President of the Canal Commission. Berlin: Wilhelm Ernst & Sohn. 4to; pp. 61; 34 photo. plates; 12 marks.

This book, which is written to commemorate the opening of the North Sea and Baltic Canal, on June 20 and 21, 1895, is principally intended to give the lay reader a comprehensive and appreciative idea of the history and magnitude of the work, and it does not, therefore, attempt to exhaust its engineering problems. At the same time, the technical reader will not fail to find much of interest in the text, and in the numerous and handsome photographic views and reproductions of maps and construction plans which the book contains. According to the author, the idea of cutting a ship canal through the Danish peninsula originated with King Christian III., of Denmark (1533-1559). After his time it was frequently proposed, until, in 1784, the Eider Canal was built. An interesting account of the origin and development of this project is given. The canal is considered a good piece of engineering work for its time, and it has rendered valuable service for more than 100 years. Its modest capacity became, however, in the course of time, more and more inadequate to meet the growing requirements of the shipping trade, and since 1820 the subject of improved canal facilities has again been agitated from various sources. A review of the different projects of this nature and their political history then follows, leading up to the inception of the plan for the present canal, and finally the appointment by the Emperor of the Canal Commission in 1886. The remaining part of the text is devoted to describing the preliminary work and construction of the new canal, including its locks, machinery, bridges and ferries. There is also a list of officers and engineers, with an enumeration of all workmen employed in the canal, and a description of the means provided for their health and comfort. Finally, a statement of the cost of all work is given, which, unfortunately, does not include the "quantities" for each class of work; and, as a consequence, is of little real value.

The photographic illustrations are very handsome and clear, and pertain exclusively to the works of the present canal. Several of these illustrations have been given in Engineering News. Notable among the photographs are those of the Holtenau locks, and the fixed street arch bridges at Levensau and Grumenthal, spanning the canal from bank to bank, at a sufficient elevation to admit of the passing of ships beneath.

HANDBOOK FOR SURVEYORS. By Mansfield Merriman, Professor of Civil Engineering in Lehigh University, and John P. Brooks, Instructor in Civil Engineering in Lehigh University. New York: John Wiley & Sons. 12mo; pocketbook form; pp. 234; $2.00.

In issuing this pocketbook, the authors undoubtedly meet a demand. Works on surveying were plentiful enough, but none were in shape for handy use in the field. As arranged, this work can be used in the class room of technical schools as well as by surveyors in their regular work. It includes the fundamental theoretical principles of land and town surveying, leveling and simple triangulation; and while no space is expended in describing and illustrating instruments with which even the student is supposed to be familiar, the methods of testing and comparing instruments are given more fully than usual in works of this character. The handbook departs from old customs in substituting for the terms "latitude" and "departure," terms borrowed from navigation, the expressions "latitude difference" and "longitude difference," as is now the universal practice in geodetic surveying. Taking up the contents in detail, we find the work divided under five main heads of fundamental principles, land surveying, leveling and triangulation, topographic surveying, and tables. Under the first head we have the fundamental principles clearly and concisely set forth with the various simpler problems of surveying solved according to the latest practice. Under the second head space is first devoted to chains and metallic tapes, the surveyor's transit and the magnetic needle, and the methods of keeping field notes and conducting surveys and resurveys for farms and U.S. land surveys, the latter being briefly explained. The adjustment, comparison and the use of the level follow, with field notes, mapping of contours, etc.; and under this same main head come the adjustment, use and comparison of transits, standard tapes, base-line measurement, corrections and the methods of triangulation. The chapter on topographical surveying is divided into large and small scale topography, according to the use intended; and here we have the theory and use of the stadia fully set forth along with the plane-table. Hydrographic and mine surveying also follow, and the handbook proper concludes with the methods of establishing the true meridian. The tables of natural functions are carried to five decimal places, and those of logarithms and logarithmic functions to six places. The 12 series of tables include all that are deemed of practical value to the ordinary user, and include daily variations of the magnetic needle, stadia reductions, metric and English measures, etc. The method of treatment throughout is simple, clear and concise.

A MANUAL OF MARINE ENGINEERING; Comprising the Designing, Construction and Working of Marine Machinery. By A. E. Seaton, M. Inst. C. E., etc. 12th ed., revised throughout and enlarged. London: Chas. Griffin & Co. New York: D. Van Nostrand Co. 8vo; cloth; pp. 585; 148 illustrations.

The first edition of this work was published in 1883, and it is well known as one of the best works in the language on its subject. In the present edition, the text has been brought down to date, numerous changes having been made necessary by the development of marine engineering practice in recent years. An entire new chapter on water-tube boilers has been added, in which the Babcock and Wilcox, the Normand, the Thornycroft, the Yarrow and the Belleville boilers are described and illustrated. The author gives the torpedo boat, with its machinery, the credit for being the pioneer which has led, since 1880, to the introduction of high-speed steamers of all kinds and of every size. While the work is invaluable to the marine engineer, it will also be found a valuable addition to the library of the designer or student of stationary practice, since the marine type of steam engine is becoming quite generally used on land, and the principles and the proportions of parts of marine engines, which are exhaustively treated in this volume, are largely applicable even to those land engines which are not of the marine type. The methods of construction of boilers which are adopted on marine practice are also well worthy of study by those interested in land boilers, although the usual marine type, the Scotch boiler, is but rarely used on land. On the whole, the book is one of the most satisfactory treatises on the steam engine with which we are acquainted.

PLATE GIRDER RAILWAY BRIDGES.—By Maurice Fitzmaurice, M. Inst. C. E. London: E. & F. N. Spon; New York: Spon & Chamberlain. 8vo; cloth; pp. 104; 4 folding plates and 36 cuts; $2.40.

So many points in plate girder design are based on empirical rules only, thus admitting of varying practice, that an engineer examines this book with more than usual interest, to see how the practice of our English cousins compares with that of American designers. In a measure he is disappointed, for the work is elementary in its scope; but still a careful perusal brings out many points of interest. Perhaps the first thing which strikes one, glancing over the illustrations, is the apparently tacit assumption that solid metal floors are always used. To the American this appears a little curious, but the English engineer would hardly look for any different thing. For the longer span through bridges transverse trough floors riveted to the lower flange angle and web of the girder are used, or else longitudinal troughs resting on cross girders. For shorter spans the variety of floors is very great. Ballast may or may not be used. The author considers the ballasted floor safer under derailment, and to give a better riding surface, but states that the unballasted floor is more easily drained and painted, is of less weight, and distributes the wheel loads somewhat better. It may be noted here that the method given for calculating train-load stresses is to use an equivalent uniform load rather than the concentrated wheel loads nearly always used in this country. In double-track bridges a depth of girder equal to from 1-10 to 1-11 of the span is recommended for three-girder spans up to 40 ft., and of 1/8 to 1-10 the span for two-girder spans up to 80 ft. On the much-discussed question of web stiffeners, the author says: "A very simple plan is given by Rankine for determining these, based on the strength of the web to resist buckling treated as a column," but states that such a calculation is not often made, and that stiffeners are usually spaced not more than 6 ft. or 7 ft. apart near the center, and, of course, much closer near the ends, the designer usually drawing upon previous experience in deciding the question. In constructing the girder flange, the writer gives a method of stiffening the compression flange which we do not recall having seen before, but otherwise English design here differs little from American. This novel method of stiffening is to rivet angles at the bottom outer edges of the cover plate, giving the flange a channel shape with the channel flanges projecting downward. The confessedly elementary character of the book should, perhaps, make us refrain from drawing any broad conclusions, but aside from their universal use of solid floors, it does not suggest that we have anything to learn from English engineers in plate girder design. The book is well printed and illustrated, and has an adequate index.

ARCHITECTURAL ENGINEERING, with Special Reference to High Building Construction. By Joseph Kendall Freitag. New York, 1895: John Wiley & Sons. 8vo; cloth; pp. 239; 120 illustrations; $2.50.

No better indication of the firm position which steel and iron building construction has assumed in the engineering world is afforded anywhere than in the rapidly-increasing literature on their design and construction. For several years past the technical papers have given constantly-increasing attention to skeleton steel building construction, and now engineering writers are beginning to collate and gather together these records of practice and experience into the more permanent form of treatises. The book before us is one of the first of these treatises, and is a most commendable work in many respects. It is true that the close student of steel building construction will find in the book much that has been made familiar to him in other forms, but nowhere will he find it in so convenient a shape for practical use.

Beginning with a consideration of the selection of adequate fireproofing, the discussion proceeds in succeeding chapters to the calculation of floor loads, spandrels, exterior walls, columns, wind bracing, and miscellaneous items, until finally the selection of a foundation construction to bear these loads is considered. Many illustrations and examples of actual construction are given under each of these heads, and form a most valuable feature of the work. In the annoying question of detailing spandrels, supports for cornices, bay windows, etc., the author has had the good sense to present these drawings in especial abundance. Few questions that come up in steel building design are more puzzling to the brain and trying to the patience of the engineer than spandrel detailing, and a general description of such work is almost useless to aid him. This chapter and the chapters on fireproofing, wind bracing, columns, and foundations are especially deserving of notice for their close adherence to the best practice, and condemnation of the cast iron, knee-braced abortions so often seen. Two features to which much more attention could have been given with advantage are roof design and stair construction. Neither of these is adequately treated, and the author can do nothing which will improve his book more than to cut out in the next edition his introductory dissertation on the brotherhood of architecture and engineering, and give the space to details of roof and stair design.

The book has a good index, and the publishers' work is generally satisfactory.

ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The 14th annual meeting was held at Montreal, Canada, Oct. 15 to 18. At the opening meeting an address of welcome was made by the Mayor, Mr. J. A. Villeneuve, which was responded to by Mr. Hurt, President of the Association, who afterwards delivered the annual address. In this address he stated that there are in the United States about 179,300 miles of steam railways, and 13,500 miles of street railways. The former have a total capital of $11,000,000,000, and during the past year the passenger receipts were $276,031,000, and the profits $322,000,000. The latter have a capital of $1,300,000,000, and their gross receipts were between $125,000,000 and $140,000,000, while the profits were $43,000,000. Among the new branches of business to be cultivated are the handling of freight and mail, the delivery of small parcels from retail stores through a system of express, the handling of building material to suburban localities, the handling of milk on special cars, and the operation of funeral cars from any portion of the system into cemeteries. The relation of street railways to steam railways is growing more interesting, and in some localities even perplexing, until the question is now being asked, What will be the solution of the extension of electric lines, which are cutting so rapidly into the business of the steam railways? and it seems that the interests of these two systems of transportation may force an amalgamation of the systems, having thereby the main lines connecting distant points, which will be operated into stations at convenient points in municipalities, from which passengers will be transported over various street railway lines to their destinations.

The report of the Treasurer showed for the year: Receipts, $7,554.57; expenses, $7,240.55; balance on hand, $314.02.

At the afternoon session the first paper presented was one by Mr. E. J. Wessels, on "The Present Status of the Air-Brake," strongly advocating the use of this system of braking for street cars, and pointing out that it must be properly fitted and cared for if the full benefits of its work are to be obtained. The paper treated the subject broadly, however, and did not give any description of such air-brakes, or statistics of their

use. The discussion, however, was of a more practical character, and we give an abstract as follows:

Mr. Scullin (St. Louis).—About two years ago we tried two brakes—the Eames vacuum brake, made by the New York Vacuum Brake Co., and another vacuum brake made by a man named Eames, in Atlanta. The main trouble with these brakes was in running through crowded sections. Our speed was so slight, and we had to stop so often for wagons, that it was almost impossible for us to keep the pressure strong enough to use the brake. We also found that on account of connecting the vacuum brake to the same rod as the hand brake, the hand brake was constantly neglected and it became almost impossible to use it. In the suburbs we had no trouble in keeping the pressure. We had cases where the brake failed to work on account of the wires coming in contact with the piping of the brakes, wearing the insulation of the wires, and short-circuiting and burning holes through the pipe. We did not see how we could remedy it.

Mr. Wessels.—No air-brake is fit to be in service which has not always available a minimum of 50 stops in reservoir capacity.

Mr. McCulloch (St. Louis).—One of the roads which run parallel with one of our lines was so sure about two years ago that it had everything that was desirable in the way of an efficient air-brake, that it equipped a very large electric car, seating 52 persons, having 13 double cross-seats on each side of the car, with an aisle in the middle. At first everybody was very much pleased with it. The motorman could stop the car without any effort whatever, and the managers of the road were so pleased that they equipped a number of the cars with this brake, at considerable expense. By the time they had 10 or 12 cars equipped, the repairs began to come in, and they called a halt in the matter. The result was, that no more cars were equipped with air-brakes, and, to-day, they have not an air-brake in use. They found they could not keep the brakes in such condition that they were always reliable. The trouble arose principally from the fine particles of dust cutting out the packing in such way that there were leaks, which could be taken care of only at such expense that it became prohibitory, and, to-day, there is not an air-brake in use in the city of St. Louis.

The question of street paving along the tracks was then brought up by Mr. Seely, of New York. He stated that in a certain city the railway company is compelled to pave its strip, 18 ft. in width, with the same material that the city officials use for the remaining portion of the street. In paving one street with asphalt, the paving contractor refused to do the work unless the railway company entirely suspended its service, taking all cars off. The contractor paved one piece, and after that was done, the railway company decided it would not give up the street, and the matter has gone into the courts. The paving company has refused now to pave that portion of the street, claiming that it could not be done while the cars were in operation, and especially that the concrete would not set with the cars running over the rails while it was being laid, and the railroad company has commenced to put in that concrete itself, keeping the cars moving at the same time. This is quite successful so far, the concrete being laid, headers and stretchers being put in, and cars moving right along. Of course, it is expensive. The next problem is, Who will pave the top of the concrete with asphalt? and the railway company is thinking seriously of starting a plant of its own.

Mr. Johnston, of Richmond, Va., said that in Philadelphia the company is required to pave the whole street, and not merely a strip. In no case had he given up the street to the contractor, and he thought it is a piece of contrariness on the part of any contractor to say that he cannot lay the paving without stopping the cars. In Richmond he is going to put in a track laid on concrete, and does not propose to stop the cars.

Mr. McCulloch, of St. Louis, said that his road paves between the rails and one foot outside, and between double tracks, with the same material as the rest of the street. The men are now at work on two very busy streets, one originally paved with asphalt, and the other with granite, both underlaid with concrete. The asphalt men, the concrete men, and the granite men are all paving, and the cars are in constant operation, without any hindrance or suggestion of interference, no contractor or paver ever having asked for the discontinuance of the running of cars. It would not be tolerated by the Board of City Works.

On Wednesday there was an "executive session." Afterwards, a paper on "Transfers," by Mr. Baumhoff, of St. Louis, was read, and there was a discussion on "The Labor Question." Mr. Hamilton then read the report of the Executive Committee, together with the amended constitution and by-laws proposed by the committee. The report stated that the committee had found, to its surprise, that the Association was largely in debt, its liabilities exceeding its assets by nearly $5,000. These liabilities were the accumulation of several years, in which the sum of the actual expenditures and the bills contracted, but not settled, had exceeded the receipts. There was on extravagance in the conduct of the Association's affairs, but the receipts have merely been insufficient to take care of all the work laid out at the annual meetings. The chief criticism that the committee made was that the situation ought to have been faced long ago. The new constitution did not provide for the admission of supply men as Associate Members, but this question was brought up, and warmly discussed from both points of view, resulting in the adherence to the present plan of having the membership limited to street railway companies. The amount required to clear off the debt was raised by subscription.

In the afternoon there was a reception given by the authorities of McGill University.

On Thursday, Mr. Wm. J. Hammer, Chairman of the Committee on Standard Rules for Electrical Construction and Operation, of the National Electric Light Association, presented, by permission, a resolution from that committee advocating the formation of a joint committee representing the various companies, scientific bodies, etc., interested in electrical work, to arrive at a standard code of rules. It was agreed that a delegate to this joint committee would be appointed by the executive committee. The paper by Mr. W. L. Brown, of Atlanta, Ga., on "Ties and Poles," was then read, and of this we give an abstract elsewhere. Following this came the report of the Committee on Patents, pointing out the trouble that the companies have over patents and patent suits, many of the patents concerned being valueless. It recommended that a bureau similar to the Western and Eastern railway associations be established, to handle all matter pertaining to patents.

The officers for the ensuing year were then elected, as follows: President, H. M. Littell, Brooklyn, N. Y.; First Vice-President, Granville C. Cunningham, Montreal; Second Vice-President, William H. Jackson, Nashville, Tenn.; Third Vice-President, J. Willard Morgan, Camden, N. J.; Secretary and Treasurer, T. C. Penington, Chicago, Ill. Executive Committee: Joel Hurt, Atlanta, Ga.; Prentiss Cummings, Boston, Mass.; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa.; and W. F. Kelly, Columbus, O. It was also voted hold the next annual meeting at St. Louis, Mo.

The committee appointed to report upon the necessity for the use of salt and sand upon street railway tracks during the winter, in order to remove ice and snow, and make the running of cars safe and practicable, submitted the following report:

The use of salt on the rails at certain times and during certain conditions of weather is absolutely necessary, in order to clear the rails of a film of ice that will otherwise form on them. Without the use of salt, it would be very unsafe to operate cars on a hilly system during winter, and your committee is of opinion that no road can afford to dispense with its use. Salt has been used on street railways throughout the United States constantly while horse cars were in vogue, and now, more than before, is its use imperative in the operation of electric cars.

In like manner, sand is a necessity on the rails, in order to give the wheel a "proper grip" on the track.

In the city of St. Louis, Mo., the quantities of salt dumped on the tracks is in excess of 3,000 tons in the course of one winter. There is no objection on the part of the local authorities, or health board, to its use, and but for the use of this salt, it would be impossible to operate our cars. The use of sand is also absolutely necessary, and its use is not interfered with in any manner, any more than is the use of salt.

On Friday the subject of "Furnishing Free Music and other Entertainments by Street Railway Companies to the Public" was briefly discussed. Mr. McLean, of Indianapolis, said that the Citizens' Railway Co. owns the only park of any size in that city, comprising 265 acres, and finds it very profitable during the summer to give entertainments there, particularly in the way of band concerts, and they have attracted many thousands to the park, especially on Sunday afternoons and evenings. Mr. McClary, of Birmingham, said that his company has a park of about 100 acres, with a lake 33 acres in size, with pavilion, walks and drives, and every weekday night, except Saturday, during the summer, there is a band playing music for dancing. Every Sunday afternoon there is a sacred concert. No accidents have occurred in handling the crowds.

A paper on "Electric Heaters for Street Railway Cars" was presented by Mr. J. F. McElroy, who had read a similar paper before the New York State Street Railway Association, an abstract of which was published in our issue of Oct. 3.

After the installation of the new officers, the meeting adjourned until its meeting in St. Louis, Mo., in October, 1896.

ANNUAL CONVENTION OF THE ROAD-MASTERS' ASSOCIATION OF AMERICA.

The thirteenth annual convention of the Association was opened at the Southern Hotel, Oct. 15, with about 90 members and a large number of guests present.

After an address of welcome by the Mayor and some informal speech-making, the convention proceeded to business, with Vice-President C. E. Jones in the chair, in place of President Robert Black, who had been unexpectedly called away.

After the election of 20 new members, the balloting for officers of the Association was then begun, and resulted in the choice of Mr. C. E. Jones (C., B. & Q.), President; Mr. J. A. Kerwin (C. & N. W.), First Vice-President; Mr. F. R. Doty (Ill. Cent.), Second Vice-President; Mr. J. B. Dickson (C. & N. W.), Secretary and Treasurer, and Messrs. John Doyle (Chic. & W. Mich.) and J. O. Walker (P., T. & A.), members of Executive Board. Immediately after the election the reading and discussion of the various committee reports were begun.

The first report was on "Joint Fastenings," which was read by the chairman, Mr. J. W. Wright. The report called attention to the fact that heavier locomotives and cars were constantly being adopted, and to the consequent need of strengthening the joint fastenings of rails. The fishplate was satisfactory as far as the fishing or joining together of separate rails was concerned, but it was deficient in supporting the ends of the rails. Therefore, in the best rail joints now in use is found a combination of the fishplate for holding the rails together and a bridge or truss for supporting the rail ends. The various joints tested by the committee were the Weber, Continuous, Price, Eno, Truss and Heath. Both the Weber and Continuous had been in service too short a time to enable any comparison of cost. The Price and Eno joints had been in service two years, with apparently successful results. About 500 Truss joints had been in service for six years, and had shown a saving of 30% in maintenance, and probably 60% in increased life of the rail. The Heath joint is reported by those using it to give good satisfaction, as a rule.

In discussing the report, Mr. J. D. Dickson (Chic. & N. W.) stated that Long's truss joints had been in use on about 1½ miles of down-grade track subjected to an exceptionally fast and heavy traffic for six years, and all were in good condition. The track was gravel ballasted, and had 72-lb. rails, and there was not a battered rail end in the whole length. The labor of maintaining the track and joints was not one-half what it was on ordinary track. Mr. F. Rockwell (Mo., Kan. & Tex.) stated that this road had 200 miles of track laid with the Continuous joint, and had just finished laying 40 miles more, using 75-lb. rail. The joints had given perfect satisfaction. But few had broken, and in these cases the break was generally due to imperfect material. On the Hannibal division the road had 40 miles of the Continuous joint and 35 miles of ordinary angle bars, and there was a difference of $10 a mile per month in cost of maintenance in favor of the Continuous joint. Mr. J. L. Single (Long Isl.) stated that this road had also used Continuous joints with very good satisfaction. About four miles of one track were laid with them, the opposite track having ordinary angle bars, and the cost of maintaining the angle-bar track was five times as much as the cost of maintaining the continuous joint. Twelve Weber joints had been put in for an experiment, and they had also shown good results. There was some further discussion, but little additional information was brought out.

The next report was on "The Advisability of Increasing the Length and Using Miter Joint Rails," and was presented by Mr. John Doyle (C. & W. M.). The following is a quite full abstract of the report:

Rails of a greater length than 30 ft. can be used with safety and economy. Experiments have been made which show that no objectionable feature has developed in the expansion and contraction of rails over 100 ft. in length, and actual experience from observation with the use of rails 45 and 60 ft. long confirms this. This being the case, there can be little doubt as to their safety. The economy in the use of longer rails is in the reduction in the number of joints and their maintenance, which is a matter of simple calculation, less the additional cost of manufacturing, transporting and handling, which would vary on different roads, in accordance with their distances from the point of manufacturing and the methods of handling. The additional increase in length, which we now think is within the unit where the reduced cost of maintenance would be balanced by the increased cost of making and handling, is from 45 to 60 ft.

A few miter-cut rails in use on some roads have failed by parting at the ends between the web and the head. We believe this trouble to be caused more on account of the particular form of the section or a mechanical defect in the manufacture, than on account of the miter cut. With these two objectionable features removed, we recommend the use of rails cut in this way.

Miter-cut rails can be used with safety as facing points when cut at an angle of 55° to 60° to the axis of the rail. We would, however, favor their use as trailing points only for double track. The strongest form of angle bar now made, supported on a tie and having not less than six bolts, will answer for miter-cut rails. In addition to this we would recommend the use of one or two stops on the center of the rail to more effectually prevent creeping. From the data at present before your committee they are unable to give the difference in the life or the additional cost of miter-cut over square-end rails.

In the discussion some question arose as to the experience of the Lehigh Valley R. R. with miter joints. Mr. A. Morrison (L. V.) stated that this road used 60-ft. rails, and the chief advantage of the miter joint was that the wheel always rested on some portion of the rail and reduced wear. He stated that the reports of the breaking of the rail ends with miter joints were wrong, for, so far as his experience went, they were no more liable to break than rails with square ends. He claimed that long rails could be handled as easily as short rails, and could be laid more cheaply. Moreover, the long rails when cut were more easily utilized. A number of other members spoke in favor of longer rails, but few had had any experience with miter joints. On the motion of E. P. Hawkins, a resolution was passed that it was the sense of the convention that it was advisable to in-

crease the length of rails to 45 or 60 ft., and that they should be cut with either square or miter joints, with miter joints preferred for double track.

The next report was that on "Hollow Tires and the Injury Caused by Them to Split Switches, Spring Rails and Rigid Frogs." The following is an abstract of the report:

The damage to spring rail frogs from this cause consists mainly in battering and shearing off the wing and point. It is on this class of frogs that the greatest danger of derailment from hollow tires exists, for, in trailing the frog, the tendency of the hollow tire is to crowd the spring wing out; the gage is thereby widened, and the result is derailment. Again, each time an engine with hollow tires crosses a spring frog, a severe blow is delivered to both the point and wing rail; this, when given to the spring wing, after a time causes it to become bent or strained, which retards the free and natural action of the spring, so that the spring wing cannot be depended upon to close properly after the switch is used, and here lurks danger of derailment, which, when traced to its primary cause, invariably points to the hollow tire. The swing given to a locomotive with hollow tires, when running over a frog, causes the gage of both the track and guard rail to be affected, and the general line of the frog to become ruined, thereby necessitating frequent readjustment.

As a measure of safety, when hollow tires are allowed to run, the spring rail should be planed down where the tire first comes in contact with it; this will allow the wheel to mount the wing, without so great a chance of the wing being crowded out and the engine derailed. There should also be a flaring opening left at the point, as the flange would be started in before putting any pressure on the spring wing, thus relieving the guard rail. The damage to rigid frogs by hollow tires is of the same nature as to spring frogs, but the danger of derailment is not nearly so great: The effect of hollow tires on split switches is about the same as on spring frogs, there being great danger of derailment when a locomotive with badly worn tires trails through. If these switches were never used by engines with bad tires, it would not be necessary to elevate the point above the stock rail; but, under existing circumstances, we think the point should be planed down so that it is not less than ¼ in. lower than the stock tail at the point, and rising gradually until it is not less than ¼ in. higher than the stock rail at a joint where the planing of the head of the switch rail ends. We would recommend that the wear on tires be not allowed to exceed ⅛ in. on engines used on high-speed trains, and not to exceed ¼ in. on all other engines.

Considerable discussion followed the report, mostly relative to the amount of wear which should be allowed to the tires and the damage done by badly worn tires to the track. The opinion of the convention seemed to be pretty accurately expressed in a resolution passed at the close of the discussion. This resolution recommended that the wear on tires should not be allowed to exceed ¼ in. on locomotives of all classes, and that a brakeshoe be used which will wear down the outer surface and flange of the tire to equal the wear on the part which bears on the rail.

The first day's proceedings were closed with the announcement of the prizes awarded by the "Railway Age," of Chicago; the first prize, of $125, going to H. G. Hetzler (C., B. & Q.), and the second prize, of $75, to H. W. Church (L. S. & M. S.).

Wednesday's Proceedings.

A verbal report of the Committee on the Preservation of Ties was made by Mr. J. Collum (L. S. & M. S.), who sated that the committee had prepared no written report, but presented a number of letters relative to the subject. The report was received as information. A brief report on the "Best Form of Records and Reports for Maintenance of Way Department" was then presented. This report showed a variety of forms of report blanks used by different railways, and was but briefly discussed. There was some further discussion of the subject of track joints, and the members adjourned to inspect the works of the Elliot Frog & Crossing Co., at East St. Louis.

Thursday's Proceedings.

The first work was the reading of the report on Standard Track Tools. The various standards were illustrated by blueprints, and in another issue some further mention and illustrations will be given in connection with the principal discussion.

The subject of the preservation of ties was then called up, and Mr. A. Morrison (L. V.) spoke at some length regarding the value of tieplates as preservers of ties. The convention then proceeded to the balloting for the next place of meeting, and Niagara Falls, N. Y., was finally selected.

A feature of the convention which should be especially mentioned was the provision of the local members for excursions and visits to manufacturing plants and other places of interest to railway men. These the members took advantage of in considerable numbers, but a commendable disposition not to indulge in "junketing" trips, to the detriment of the work of the convention, was shown througout. Another interesting feature was the very complete exhibit of the manufacturers of railway track supplies and machinery in the corridors of the Southern Hotel. Special credit is due to the managers of the hotel for furnishing every facility for the accommodation of both the exhibitors and the Association. A list of the principal exhibitors is given in our column of "Industrial Notes" in the Supplement.

ANNUAL CONVENTION OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

The fifth annual convention of the Association was opened at the Hotel Grunewald, New Orleans, La., Oct. 15, with about 40 members and guests present. Mr. J. L. White (Tex. Mid.), in behalf of the bridge and building department of that road, presented the Association with a banner commemorative of its fifth year of existence, and, after a brief word of thanks, Pres. Geo. W. Andrews (B. & O.) delivered his formal address. Mr. Andrews spoke chiefly of the work of the officers of the Association during the past year, and called attention to the fact that some improvements in its methods of work would be proposed during the convention. The most important of these was a proposal to print and distribute advance copies of the committee reports, so that the members might have an opportunity to read them, and prepare discussions in advance. It may be stated at once that this recommendation was later on adopted by a vote of the convention.

The report of the Secretary, S. F. Patterson (Conc. & Mont.) showed the Association to have 115 members, and to be in good financial condition. It was then voted to increase the annual dues to $3, and to change the name of the organization to the Association of Railway Superintendents of Bridges and Buildings, dropping the words American International. After a little further routine business, the convention proceeded to the reading of the various committee reports.

Several of the committees had failed to present reports, or else asked for an extension of time, to secure further information, so that of the 11 reports on the programme, only six were actually presented. As the discussion of these reports was deferred until the second day of the convention, their consideration is deferred until the record of that day's proceedings is given.

Following the reading of the reports, the convention took up the review and discussion of last year's committee reports. The first of these was the "Maintenance of Pile Trestles," and the discussion reverted almost entirely to the use of creosoted timber. Mr. C. C. Mallard (So. Pac.) described the creosoted solid-floor trestle illustrated in our issue of May 16, 1895, and stated that it gave an easy-riding track, and a fireproof structure. In reference to repairs, he thought that the use of creosoted timber would relegate them to the consideration of the next generation. So far no repairs had been necessary. The next subject taken up was the "Best Foundation for Track Scales," and a variety of opinion was developed in the discussion. It was quite generally agreed, however, that where the foundation bed was good and stone handy, masonry was the best foundation in all respects. Mr. C. C. Mallard (So. Pac.) stated that on his and other roads in the soft soils of Louisiana, piles were the only thing that would make a satisfactory foundation. Mr. J. L. White (Tex. Mid.) stated that he had used timber grillages in several instances, and that they gave good results. He thought, however, that in every case the conditions of foundation bed and cost of material must determine what was a proper foundation. These discussions closed the proceedings of the first day, with the exception of some routine work of special committees.

Wednesday's Session.

The convention proceeded at once to the discussion of committee reports presented the day before. The first report taken up was that on "Best Methods and Special Appliances for Building Temporary Trestles over Washouts and Burnouts." This report was merely a reprint of a paper presented before the New York Railroad Club by Mr. W. L. Derr, and abstracted in our issue of March 14, 1895, and will not be reproduced. There was no discussion of importance, and the report on "Sand Driers, Elevators and Methods of Supplying Sand to Locomotives" was taken up.

The report consisted for the most part of descriptions of individual plants in different parts of the country, accompanied by blueprints showing design and construction. Some of the more interesting of these will be illustrated in a future issue. The general conclusions of the committee were that it was the best economy, wherever any great amount of sand had to be handled, to do the work by machinery. The sand, after drying, should be conveyed mechanically, or by hand, to elevated hoppers, and fed to the engines by means of chutes. In hand elevating, a windlass could be used, and it was stated that one man could attend to the drying and also elevate sand enough for 20 engines per day with the windlass. The advantage of charging the engines from elevated hoppers was the saving in time and labor, and the avoidance of dropping sand onto the guides, which often happened when buckets were used for charging. A sand plant should have a green sand bin large enough to hold the entire winter supply, in cold countries, while the hopper should hold about one day's supply. The drying of sand by steam was not favored by the committee, but the statement was made that steam driers were used by a number of railways. The kind of drier recommended was a stove. In all cases the sand house should be fireproof, and located so that coal, water and sand could be taken without much moving of the locomotive.

This report was not discussed to any great extent, as most of the members had little to do with sand plants after they were once erected. Mr. R. M. Peck (Mo. Pac.) stated that stoves were used for drying sand on his road, and he preferred them to steam coils or radiators.

The next report was that on the "Strength of Various Kinds of Timbers Used in Trestles," and it proved to be the most complete and valuable report presented. This report is abstracted in another column. There was no discussion.

The report on the "Best Method of Erecting Plate Girder Bridges" was next in order. Two members of the committee presented letters giving their ideas on the subject, but there was no report of the committee as a whole. The method advised by Mr. G. W. Hinman (L. & N.) was to erect temporary wooden bents at each end of the bridge to be replaced, with the tops of the bents level with the tops of the permanent bridge seats. On the caps of the bents old rails were to be spiked, and on these the girder span was to be erected complete—ties, rails and all. The old structure was to be removed, and the new span hauled sidewise into place. For spans of 60 ft. or over, winches were needed to do the hauling, but shorter spans could be put into place with pinch bars.

There was very little discussion, Mr. A. C. Shane (C., C. & St. L.) seeming to voice the ideas of the members in stating that a special method was needed in every case, and no very general plan suitable to all conditions was possible.

The next report was that on the "Best Method of Spanning Openings Too Large for Box Culverts in Embankments Too Low for Arch Culverts." The method recommended was as follows: Abutment and wing walls of rubble masonry laid in 1 to 2 natural cement mortar, with a roof of old rails, bound together with iron rods at the ends, and covered with from 4 ins. to 12 ins. of concrete, and from 12 ins. to 18 ins. of ballast. At the ends of the rails an I-beam should be placed, to hold the ballast from sifting through. The floor, or waterway, should be of concrete or flagstones, and should be extended down stream beyond the culvert enough to prevent danger from washing. This form of culvert has been used on the Missouri Pacific Ry., Kansas City, Ft. Scott & Memphis R. R., and other Western railways, with good satisfaction. They are used for all spans up to 12 ft., but on spans of 8 ft. or over, an I-beam was generally placed under each rail, to give additional strength.

The discussion which followed turned into something of a quibble as to what a box culvert was, and very little of value developed, although the culvert recommended in the report was quite generally approved.

The last report to be considered was that on pumps and boilers, and it contained very little of value, no particular make or style of either pumps or boilers being recommended. The discussion developed but little additional information. The chief things to be secured were an arrangement to prevent freezing and to enable the combustion of poor coal. The size and style of the pumping plant depended in each case upon the conditions, and the statements of the members showed all sorts and styles of machinery in use.

This finished the discussion of the committee reports, and the reports of special committees and election of officers for 1896 were taken up. The following list of subjects was announced for committee reports at the next convention, which it was voted to hold at Chicago:

(1) "How to Determine Size and Capacity of Openings for Waterways; (2) "Different Methods of Numbering Bridges. Should all Waterways be Numbered?" (3) "Drawbridge Ends. Methods of Locking," and under this head include "Locking of Turntables;" (4) "Protection of Trestles from Fire, including Methods of Construction;" (5) "Local Stations for Small Towns and Villages, Giving Plans of Buildings and Platforms; (6) "Tanks, including Frostproof Protection to Tank Pipes;" (7) Causes of Shearing of Rivets in Through Plate Girders;" (8) "Best and Uniform System of Report Blanks for Bridge and Building Department."

The subjects of reports held over from this year were: (1) "Mechanical Action of Locomotives at High Speeds upon Bridges;" (2) "Best and Most Economical Railway Track Pile Driver;" (3) "Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate Girders and Lattice Bridges for Spans from 50 ft. to 110 ft;" (4) "Interlocking Signals."

The following officers were elected for the year of 1896: President, W. A. McGonagle, D. & I. R.; First Vice-President, L. K. Spafford, K. C., F. S. & M.; Second Vice-President, James Stannard, Wabash; Third Vice-President, Walter G. Berg, L. V.; Fourth Vice-President, J. H. Cummin, Long Island; Secretary, S. F. Patterson, Concord & Montreal; Treasurer, Geo. M. Reid, L. S. & M. S. New members of the Executive Committee: A. S. Markley, C. & E. I.; W. M. Noon, D., S. S. & A.; J. M. Staten, C. & O.

On Thursday there was an excursion to the sugar plantations and refineries along Bayou Teche.

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PERSONALS.

Mr. F. A. Leonard has been appointed Superintendent of the water-works recently built at Deerfield, Wis.

Mr. J. S. Mott has been appointed Chief Engineer of the Northern New York R. R., with headquarters at Tupper Lake, N. Y.

Mr. H. F. Gardner has been appointed Superintendent of the Santa Ana Valley Irrigation Co., with headquarters at Orange, Cal.

Col. T. L. Wilson, a railway builder, who has been active in the promotion of Western projects, died at Fort Scott, Kan., on Oct. 15.

Mr. William Stackpole, a maker of nautical instruments, from whom the United States Government bought all its supplies of that nature, died at Brooklyn on Oct. 21, aged 76 years.

Mr. John S. Seibert, until recently an instructor in the department of civil engineering at Lehigh University, has accepted a position as Government Lighthouse Inspector, with headquarters at New Orleans.

Mr. Henry Wood, formerly General Superintendent of the Little Rock & Fort Smith Ry., has been appointed acting General Manager of the Choctaw, Oklahoma & Gulf Ry., with headquarters at South McAlester, I. T.

Mr. Robert M. Catlin, a California engineer and a graduate of the University of Vermont, has sailed for Johannesburg, South Africa, where he is to act as consulting mining engineer in the Cecil Rhodes interest, having entered into a three years' engagement with that syndicate.

Hon. Benjamin F. Kimball has been elected President of the Concord & Montreal Ry., to succeed ex-Gov. Frederick Smyth, who retires on account of ill-health. Mr. Kimball has been identified with the Concord Ry. and its successor, the Concord & Montreal, for many years and in various capacities.

Mr. J. W. Thomas, President of the Nashville, Chattanooga & St. Louis Ry., has been made President of the Tennessee Centennial Exposition, and Mr. E. C. Lewis, M. Am. Soc. C. E., Director General. The construction is progressing rapidly, with Mr. Walter G. Kirkpatrick, Assoc. M. Am. Soc. C. E., as engineer in charge.

Mr. E. W. McKenna, General Superintendent of the Great Northern Ry., has resigned and will take charge of the works of the Pioneer Rail Renewing Co., of Chicago. Mr. McKenna has held his present position with the Great Northern since August, 1894, having previous to that time been Division Superintendent and later Assistant General Superintendent of the Chicago, Milwaukee & St. Paul Ry.

Lieut. A. M. D'Armit, of the Corps of Engineers, U. S. A., instructor in the department of civil and military engineering in the U. S. Military Academy at West Point, died on Oct. 13 at the age of 32 years. Lieut. D'Armit graduated at West Point in 1889, and after serving with the Battalion of Engineers at Willets Point, N. Y., was recently assigned to duty at the Academy. Lieut. D'Armit was a contributor to Engineering News, a paper by him on "A Rational Theory for the Strains in Columns," appearing in the issue of Nov. 8, 1894.

Mr. R. H. Chamberlain, at one time General Superintendent of the Chicago, Rock Island & Pacific Ry., and for many years Superintendent of the Chicago Division of the same road, died at Chicago on Oct. 17. Mr. Chamberlain was 60 years old, and had been in the railway service 42 years, having been connected with the Rock Island road for nineteen years, commencing as a passenger conductor. Although he has held no title since his retirement from the superintendency of the Rock Island, he has been retained by the company in other capacities.

Mr. W. G. Curtis now holds the position of Engineer Maintenance of Way of the Oregon lines and of the Pacific system of the Southern Pacific Ry., with headquarters at San Francisco. According to a circular recently issued by C. P. Huntington, President, further appointments have been made as follows: Mr. H. J. Small, Superintendent of Motive Power of the Oregon lines and of the Pacific system, with headquarters at Sacramento, Cal.; Mr. J. J. Ryan, Superintendent of Motive Power of the Atlantic system, with headquarters at Houston, Tex.

Mr. Joseph Ramsey, Jr., Vice-President and General Manager of the St. Louis Terminal Association, has been chosen General Manager of the Wabash Ry., succeeding Mr Chas. M. Hays, who goes to the Grand Trunk, as stated last week. Mr. Ramsey has been in railway service for a quarter of a century. He began work in 1887 as a civil engineer on construction. In 1890 he became assistant to the President of the Cleveland, Cincinnati, Chicago & St. Louis R. R., and later General Manager. In 1893 he assumed his present duties with the St. Louis Terminal. He also is President of the Peoria & Pekin Union, and Vice-President of the Indianapolis Union Ry.

Mr. Charles C. Brown has resigned his position as City Engineer of Indianapolis, Ind., to devote his time to his practice as Consulting Engineer. Mr. H. A. Mansfield was appointed on Oct. 9 as his successor. Mr. Mansfield was formerly City Engineer and has been a contractor for the past two years. The City Attorney decided him to be ineligible for City Engineer on account of the fact that his firm is responsible to the city for guarantees on sewers built by them. Mr. Mansfield therefore resigned, and Mr. B. J. T. Jeup was appointed Acting City Engineer on Oct. 21. Mr. Jeup is a Columbia College graduate, and has been the Assistant Engineer in charge of sewers and bridges for three years.

Mr. Oliver Ames, ex-Governor of Massachusetts, died on Oct. 22 at his home in North Easton, Mass. Mr. Ames was widely known as a financier, his vast wealth connecting him with many great enterprises, among them some of the largest railway projects in the United States. He had been a director of the Union Pacific Ry. and the Atchison, Topeka & Santa Fe Ry. He was born in 1831, and after his early education in the public schools, served a five years' apprenticeship in his father's shovel works. At the age of 20 he took a special course at Brown University, and afterwards returned to North Easton for active participation in the affairs of the Ames Company. He displayed great mechanical aptitude, and several inventions were brought out by him.

Mr. George D. Corrigan, of the firm of Palmer & Corrigan, Civil Engineers, Vancouver, B. C., was shot and killed on Oct. 9 by the accidental discharge of a gun in his own hands. Mr. Corrigan graduated from the School of Practical Science, Toronto, in 1888, was engaged with the Union Pacific Ry. in Oregon and Washington for about two years, and since has been a member of the above firm. For the last three years he had been in charge of an extensive trigonometrical survey for the Government of British Columbia, and was engaged in explorations for the same government at the time of his death. He was in his 33d year.

Mr. Willard S. Pope, M. Am. Soc. C. E., President of the Detroit Bridge & Iron Works, died at Detroit on Oct. 10. Mr. Pope was born in Rome, N. Y., in 1832. He received his education in the public schools and academy of Rome, and graduated from Hamilton College in 1851. He first studied law at Buffalo, but his health not permitting of the confinement of an office, he took up railroad work, first in Maine and afterwards with the Illinois Central and Chicago & Northwestern. In 1866 he went to Detroit and bought an interest in the Detroit Bridge & Iron Works, going into partnership with Mr. W. C. Colburn. Among the most important structures built by Mr. Pope were the three bridges across the Mississippi River at Burlington, Quincy and Hannibal. He also built the bridge across the Missouri River at St. Joseph, Mo. Each of these bridges consisted of a number of long fixed spans and a 360-ft. drawspan. At the time these bridges were built, such long draws were quite unprecedented, and involved many knotty problems to their designers and builders. Mr. Pope was one of the early members of the American Society of Civil Engineers, joining it in 1872. At the time of his death he was a member of the Board of Direction of the Society.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
Oct. 26. Secy., C. C. Brown, City Engineer.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 1. Secy., O. H. Von Geldern, 819 Market St., San Francisco.

ENGINEERING CLUB OF COLUMBUS, O.
Nov. 2. Secy., David Buell.

ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 2. Secy., L. F. Rondinella, 1122 Girard St.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 4. Secy., G. L. Annan, City Engineer's Office.

ENGINEERING SOCIETY OF WESTERN NEW YORK.
Nov. 4. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.

COLUMBIAN ENGINEERING SOCIETY.
Nov. 5. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.

WESTERN SOCIETY OF ENGINEERS.
Nov. 6. Secy., Chas. J. Roney, Monadnock Block, Chicago.

ENGINEERS' CLUB OF ST. LOUIS.
Nov. 6. "Chimneys and Chimney Draft," by W. E. Worthen. Secy., W. H. Bryan, Turner Block.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 6. "The Discharge of the Mississippi River," by Wm. Starling. Secy., C. W. Hunt, 127 E. 23d St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 7. Secy., C. H. McLeod, Montreal.

CENTRAL RAILWAY CLUB.
Nov. 8. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.

MONTANA SOCIETY OF CIVIL ENGINEERS.
Nov. 9. Secy., Forrest J. Smith, Denver Block, Helena, Mont.

ENGINEERS' CLUB OF KANSAS CITY.
Nov. 11. Secy., F. W. Tuttle, Baird Building.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 12. Secy., F. A. Coburn, Case Library Building.

DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 12. Secy., H. Breen, 36 Jacobson Block.

NORTHWEST RAILWAY CLUB.
Nov. 12. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.

NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 12. D. W. McMorris, Burke Bldg., Seattle, Wash.

WISCONSIN POLYTECHNIC SOCIETY.
Nov. 12. Secy., W. K. Means, Loan & Trust Bldg., Milwaukee.

NEW ENGLAND RAILROAD CLUB.
Nov. 13. Secy., F. M. Curtis, P.O. Box 1576, Boston, Mass.

ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 14. Secy., Jas. K. Zollinger, Norton Building.

ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 14. Secy., H. D. Ruhm, Nashville, Tenn.

ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 18. Secy., E. Nexson, Kasota Block.

WESTERN RAILWAY CLUB.
Nov. 19. Secy., W. D. Crosman, Rookery Bldg., Chicago.

ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 20. Secy., F. Van Vleck, Los Angeles, Cal.

ASSOCIATION OF ENGINEERS OF VIRGINIA.
Nov. 20. Secy., J. A. Pilcher, Roanoke, Va.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 20. Secy., S. E. Tinkham, City Hall.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Nov. 20. Secy., R. W. Pope, 26 Cortlandt St., New York.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 21. Secy., F. A. Charpiot, Macon, Ga.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 21. Secy., D. Carhart, Carnegie Library, Allegheny.

ENGINEERS' CLUB OF CINCINNATI.
Nov. 21. Secy., J. F. Wilson, Odd Fellows' Temple.

NEW YORK RAILROAD CLUB.
Nov. 21. Secy., John A. Hill, 256 Broadway, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 2. Secy., F. R. Hutton, 12 W. 31st St., New York.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting held Oct. 8, Prof. J. W. Langley, of Case School of Applied Science, read a paper on "The Electrical Purification of Sewage." He gave as his conclusion that the method is the most economical now known for disinfecting sewage. Professor Benjamin read a paper on "Evolution of Mechanical Science from Earliest Times." He stated that more money had been expended on the perfection of implements of warfare than on any other branch of mechanical invention.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—At the meeting on Oct. 17, in Allegheny, Pa., interest centered in a paper presented by Mr. Charles Hyde, his subject being "Notes of a Recent Trip to Russia." He told of the iron and steel industry there, to look into which was his special mission. At St. Petersburg there are three steel works and a number of iron manufacturing plants, the largest of these being a rail mill employing 7,000 men. The capacity of this mill is 200 tons a day, and all raw materials are imported, pig iron costing $28 a ton. The labor-saving devices are few, as labor is so cheap there is no demand as yet for improved machinery, except that the boilers in most of the works are of modern design and build. The Moscow plants were found better than those at St. Petersburg, crude petroleum being the fuel used. Comparatively little of the ore of the Ural Mountains has been developed, as fuel is scarce. There is anthracite, semi-bituminous and coking coal in the south of Russia, and limestone and other accessories to iron manufacture there which are practically entirely unutilized.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on Oct. 16, the President, Mr. S. Bent Russell, gave the club the results of some tests on bronze for tension and compression made by the Washington University testing laboratory for the water-works extension. Tables of the results, with charts and diagrams, were shown, and in the discussion it was stated that the compressive strength of metals which flow could not be determined.

Mr. William H. Bryan then read a paper on "Pamphlet Filing," explaining the difficulties he had met with in filing and indexing the many kinds of pamphlets which an engineer receives, and giving his solution of the problem, showing how all the data on any one of more than a hundred different subjects could be immediately located.

Mr. M. L. Holman then explained the break which occurred Oct. 12 in the dividing wall between two reservoirs at the Chain of Rocks. The water had broken down through the concrete bottom of a full reservoir, and up into the adjoining empty reservoir. The concrete foundation had been entirely washed away, but the wall itself was intact, leaving a span of nearly 60 ft. and a depth of 15 ft. It was proposed to repair it by concrete foundation under the wall,

and puddling work under the concrete bottom. Attention was called to the necessity of making provision for expansion and contraction of long masonry walls when built as monoliths. It was found in practice that walls which were perfectly tight in summer developed cracks of considerable area in winter. These were stopped by packing them with oakum dipped in cement, which required renewal every winter.

NEW YORK RAILROAD CLUB.—At the meeting on Oct. 17, the President, Mr. George W. West, being in the chair, a paper on "Painted or Planished Iron Jackets for Locomotive Boilers" was read by Mr. E. E. Russell Tratman, advocating the use of the former, especially where strict economy is to be observed. In the discussion it was shown that several roads were effecting economy by painting, instead of renewing their old planished iron jackets, but some members considered that, in point of appearance, nothing could be handsomer than a well-kept jacket of planished iron. The paper was illustrated by some sketches, showing how American locomotives would look if painted on the style of English locomotives, with bright colors and considerable striping and decorative work.

The discussion on "Large Railway Cars" was then taken up, and followed two lines of argument. One line was in favor of large cars to reduce transportation expenses. The other line opposed such cars, partly from the fact that as foreign roads will keep and use these cars, the owning road does not get the advantages which it should get from their use, and partly from the fact that larger cars would be objectionable on piers, floats, and at elevators, where the arrangements have been made for 34-ft. cars. It is doubtful, also, whether the strains in frames, truss rods, etc., are properly provided for even in present 60,000-lb. cars, and cars of higher capacity would have to be more carefully designed. There is also the objection due to the fact that ordinary freight cars are rarely fully loaded, though this may be eliminated by the introduction of the tonnage basis for rating train loads. Mr. Wattson thought that there should be an interchange rule forbidding cars of more than a stated capacity being run on any other than their home roads. It was voted that a committee be appointed to consider this subject, and to obtain the views of the builders and users of cars, traffic managers, superintendents, etc.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Oct. 16, the President, Mr. Geo. S. Morison, in the chair, the Secretary read a paper by Mr. T. C. Clarke on "The Effect of Depth on Inland Waterways." This paper advocated the deepening of the Erie Canal to 9 ft., and the use of fleets of steel barges to handle the traffic. Mr. E. P. North, in opening the discussion, reviewed the growth of systems of internal navigation, and their relation to the manufacturing industries of different countries, and dealt at some length with the traffic of the Sault Ste. Marie Canal. He favored a route through United States territory for the proposed ship canal between the Hudson River and the lakes, particularly as on such a route there would be a great local traffic, while on the St. Lawrence route there would be practically no local traffic. He favored a free canal, as benefiting the country at large, and stated that much of the wealth and prosperity of a country depends upon its internal transportation facilities. Mr. Chauncey M. Dutton spoke in favor of a ship canal by way of Lake Champlain and the St. Lawrence, and described a proposed steamer for lake and canal traffic, 432 ft. long, 48 ft. beam, of 3,000 HP., and carrying 265 tons of fuel and 7,265 tons of freight on a draft of 20 ft. Such a canal would give a great local traffic to the state canals, and relieve them of the through traffic. Barges 180 ft. long, as proposed by Mr. Clarke, would be impracticable on the Erie Canal, as they could not go in fleets round the sharp bends, and would require a tug at each end to handle them singly at these bends. In the written discussions presented, Mr. Richard Lamb referred to the experiments being made with his system of electric towage, and said that it was not practicable to go faster than four miles an hour with the present canal boats. He advocated steel canal boats 150 ft. long, with a centerboard for use when being towed in the lakes. Mr. T. T. Johnston referred to the possibilities of the Chicago Drainage Channel as a ship canal, in its relations to St. Louis and other river ports. Mr. W. I. Babcock, of the Chicago Shipbuilding Co., said that a barge tug would not have sufficient draft to make headway in rough weather in the lakes, and stated that the recent trip of such a tug with barges from Cleveland to Buffalo was very slow on this account.

The Secretary announced that a lot has been secured for the new Society house in New York. It is situated at 218-220 W. 57th St., on the south side, between Broadway and Seventh Ave., and has a frontage of 50 ft., with an average depth of 110 ft.

AMERICAN RAILWAY ASSOCIATION.—The autumn meeting was held at the Hotel Brunswick, New York city, on Oct. 16 and 17, 1895. There were 75 delegates present, representing 67 companies.

The President, Mr. H. S. Haines, delivered an address on "Railway Organization," in which he recommended that the Division Superintendent should have full power over all departments, so that there should be no divided authority.

The Executive Committee reported that the membership of the Association now consists of 221 companies, operating 143,154 miles of road. Cincinnati was selected as the place for the next meeting.

The Committee on Train Rules submitted a revision of the rules for the movement of trains by telegraphic orders, which was adopted. The changes were mostly of a verbal character not involving practice. The Committee on Car Service reported that, in accordance with instructions received from the Association at the meeting on April 18, 1895, it had issued a circular submitting to the members of the Association the question of the adoption of the rate of 15 cts. per day for the use of freight cars, and that replies to the circular had been received from 154 roads, as follows: Affirmative, 77 roads, owning and controlling 490,271 cars; negative, 77 roads, owning and controlling 394,669 cars. It required roads representing about 832,500 cars to vote in favor of the proposed rate in order that it might be put in effect Jan. 1, 1896. The following resolutions submitted by the Committee on Car Service were adopted:

Resolved, That the uniform rates per mile for passenger equipment, as adopted April 13, 1887, and amended April 18, 1895, be further amended to read as follows:

For coaches, chair cars, or combination passenger cars, 3 cts.; for postal cars, 2 cts.; for baggage and express cars, or combination baggage, express and mail cars, 1½ cts. These rates are to apply where the owners of the cars participate in the business, and not where cars are hired to other lines.

Resolved, That the resolution adopted Oct. 10, 1888, and amended April 17, 1895, be further amended to read as follows:

That the Association recommends that the per diem for passenger coaches, chair cars, or combination passenger cars, hired at other than mileage rates, be fixed at $5 per day, and for baggage, mail cars, or combination baggage, express and mail cars, at $3 per day, subject, however, to agreement between the parties interested. It is understood that the train trackage and other rates hereinbefore provided are recommended for use only between roads mutually agreeing to exchange service on the basis aforesaid.

Resolved, That the maximum excess allowed over the marked capacity of freight cars shall not exceed 10% of such marked capacity.

The Committee on Safety Appliances presented a report of progress.

The Committee on General Regulations for Employees reported that it had elected Mr. J. G. Metcalfe, General Manager, Louisville & Nashville R. R., chairman of the committee, and that it had at its disposal a large amount of information for examination, but was only able at this time to report progress.

The following preamble and resolutions were unanimously adopted:

Whereas, The delegates of the American Railway Association who were present at the International Railway Congress were the recipients of many courtesies and favors while in attendance upon it, especially in Great Britain; therefore be it

Resolved, That this Association desires to put on record its appreciation of the kindly treatment received by its representatives and to express the hope that the time may come when it will be possible to reciprocate.

Resolved, That a copy of these resolutions be forwarded to the officers of the English Section, Sir Andrew Fairbairn and Mr. W. M. Acworth, to whom special thanks are due, with the request that they will also convey an expression of these sentiments to those gentlemen who acted as hosts upon many pleasant occasions.

The Joint Committee on Interlocking and Block Signals presented definitions and rules for the telegraph block, the controlled manual and the automatic block signal systems, as well as the requisites of installation for the several systems. The report was taken up for consideration and discussion, after which, at the request of the committee, it was recommitted to it.

The following resolutions were adopted by the Association:

Resolved, That it is the sense of this Association that after the law requiring grab-irons and fixing height of drawbars takes effect, each railway may equip all cars belonging to any railway company with handholds or grab-irons and raise drawbars to the proper height, to comply with the law, that may be on their respective roads at that time and bill against the owners of said cars at the prices agreed upon by the M. C. B. Association.

Resolved, That the Association recommends that railway companies issue instructions prohibiting shippers from mutilating and defacing cars by nailing, pasting, or otherwise placing advertisements or placards of any kind upon freight cars.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Oct. 25.	Approaches,	Charleston, S. C.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 25.	Plumbing, etc.,	Brooklyn, N. Y.	Oct. 17
Oct. 25.	Terminal railway,	Aransas Pass, Tex.	Oct. 17
Oct. 25.	Tunnel in Amador county,	Cal.	Oct. 17
Oct. 26.	Bronze tablet, Gettysburg Military P'k.		Sept. 12
	Advertised, Eng. News, Oct. 3.		
Oct. 26.	Garbage crematory,	Evansville, Ind.	Oct. 10
Oct. 26.	Pipe sewers (2,750 ft.),	Logan, O.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 26.	Brick sewer (580 ft.),	Logan, O.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 26.	Street improvements,	Alexandria, Ind.	Oct. 17
Oct. 26.	Paving and grading,	Louisville, Ky.	Oct. 17
Oct. 26.	Inlet well,	Ft. Wayne, Ind.	Oct. 17
	Advertised, Eng. News, Oct. 17.		
Oct. 26.	Water-wks. system,	Fairfax, Minn.	Oct. 17
Oct. 26.	Cement testing machine,	Pittsburg	Oct. 24
Oct. 26.	Pipe sewers,	Pittsburg, Pa.	Oct. 24
Oct. 26.	Cells,	Boston, Mass.	Oct. 24
Oct. 28.	Brick paving,	Lafayette, Ind.	Oct. 24
Oct. 28.	Elec. ry. franchise,	New Philadelphia, O.	Oct. 10
Oct. 28.	Steam plant,	Baltimore, Md.	Oct. 10
Oct. 28.	Reformatory buildings,	Rahway, N. J.	Oct. 17
Oct. 28.	Brick paving,	Jacksonville, Fla.	Oct. 17
Oct. 28.	Fire hose,	Houston, Tex.	Oct. 17
Oct. 28.	Heating and ventilating,	Chicago, Ill.	Oct. 24
Oct. 28.	Laying water pipe,	Chicago	Oct. 24
Oct. 28.	Sewer bonds,	Plainfield, N. J.	Oct. 24
Oct. 28.	Sewers,	Chicago, Ill.	Oct. 24
Oct. 28.	Macadamizing,	Somers, Conn.	Oct. 24
Oct. 28.	Granite-block paving,	New York, N. Y.	Oct. 24
Oct. 28.	Macadamizing,	Morristown, N. J.	Oct. 24
Oct. 28.	Sidewalks,	New Brunswick, N. J.	Oct. 24
Oct. 28.	Brick building,	Milwaukee, Wis.	Oct. 24
Oct. 28.	Sewers,	Syracuse, N. Y.	Oct. 24
Oct. 29.	Brick paving,	Cincinnati, O.	Oct. 10
Oct. 29.	Grading, Gas City,	Ind.	Oct. 17
Oct. 29.	Brick paving,	Trenton, N. J.	Oct. 17
Oct. 29.	Water-works system,	Platteville, Wis.	Oct. 17
	Advertised, Eng. News, Oct. 17 and 24.		
Oct. 29.	Laying water mains,	Chicago.	Oct. 24
Oct. 29.	Grading,	Warwick, R. I.	Oct. 24
Oct. 29.	Asphalt paving,	Indianapolis, Ind.	Oct. 24
Oct. 29.	Plate girder bridge,	Indianapolis, Ind.	Oct. 24
Oct. 29.	Pipe sewers,	Troy, N. Y.	Oct. 24
Oct. 29.	Laying water mains,	Lorain, O.	Oct. 24
Oct. 29.	Paving,	Chicago, Ill.	Oct. 24
Oct. 29.	Village hall,	Park Ridge, Ill.	Oct. 24
Oct. 30.	Court house,	South Bend, Ind.	Sept. 26
Oct. 30.	Artesian well,	Denver, Colo.	Oct. 10
Oct. 30.	Grading,	Bluffton, Ind.	Oct. 17
Oct. 30.	Electric lighting,	Lexington, Ky.	Oct. 17
	Advertised, Eng. News, Oct. 17.		
Oct. 30.	Disinfecting plants,	Washington, D. C.	Oct. 24
Oct. 31.	Sewers,	Cincinnati, O.	Oct. 17
Oct. 31.	Plans for water-wks.,	W. Alexandria, O.	Oct. 17
	Advertised, Eng. News, Oct. 17 and 24.		
Oct. 31.	Asphalt paving,	New York, N. Y.	Oct. 24
Oct. 31.	Macadamizing,	Kansas City, Mo.	Oct. 24
Oct. 31.	State canal work,	Albany, N. Y.	Oct. 24
Nov. 1.	Plans school building,	Pittsburg, Pa.	Aug. 8
Nov. 1.	Plans for school building,	Pittsburg, Pa.	Sept. 26
Nov. 1.	Dike work,	Philadelphia, Pa.	Oct. 3
	Advertised, Eng. News, Oct. 3 to 24.		
Nov. 1.	County jail,	Detroit, Mich.	Oct. 10
Nov. 1.	Repaving,	Brooklyn, N. Y.	Oct. 24
Nov. 1.	Bridge,	Meridian, Miss.	Oct. 24
Nov. 1.	Sewer,	Buffalo, N. Y.	Oct. 24
Nov. 1.	Sewer,	Richmond, Ind.	Oct. 24
Nov. 1.	Macadam road,	Vernon, Conn.	Oct. 24
Nov. 1.	Paving,	Youngstown, Pa.	Oct. 24
Nov. 1.	Plans for school building,	Pittsburg, Pa.	Oct. 24
Nov. 2.	Bridge superstructure,	Cincinnati, O.	Oct. 24
Nov. 2.	Macadam road,	Baltic, Conn.	Oct. 24
Nov. 2.	Macadam road,	Waterbury, Conn.	Oct. 24
	Advertised, Eng. News, Oct. 24.		
Nov. 2.	Road,	Tipton, Ind.	Oct. 24
Nov. 4.	Court house,	Morgantown, Ga.	Oct. 3
Nov. 4.	Iron bridge,	New Orleans, La.	Oct. 17
Nov. 4.	Iron drawbridge,	Houston, Tex.	Oct. 17
Nov. 4.	Steam boilers,	Newport, Ky.	Oct. 17
Nov. 4.	Sewers,	Toledo, O.	Oct. 24
Nov. 4.	Electric light plant,	Upper Alton, Ill.	Oct. 24
Nov. 4.	Water-works,	Chenoa, Ill.	Oct. 24
Nov. 4.	Water-works system,	Upper Alton, Ill.	Oct. 24
Nov. 4.	Sewer,	Mount Vernon, N. Y.	Oct. 24
Nov. 4.	Sewers,	Sandusky, O.	Oct. 24
Nov. 4.	Macadam paving,	Orange, N. J.	Oct. 24
Nov. 4.	Brick paving,	Huntingburg, Ind.	Oct. 24
Nov. 4.	Bitumen paving,	San Diego, Cal.	Oct. 24
Nov. 4.	Court house,	Mount Pleasant, Tex.	Oct. 24
Nov. 4.	School building,	Baltimore, Md.	Oct. 24
Nov. 5.	Pile bridges,	Allison, Ia.	Sept. 26
Nov. 5.	Brick court house,	Forsyth, Ga.	Oct. 10
Nov. 5.	Plans w.-wks., sewers, etc.,	Eufaula, Ala.	Oct. 17
Nov. 5.	Iron bridge,	Greenfield, Mo.	Oct. 24
Nov. 5.	Pipe sewers,	Dunkirk, N. Y.	Oct. 24
Nov. 5.	Sewers,	New Brighton, N. Y.	Oct. 24
Nov. 6.	Electric light franchise,	Arcanum, O.	Oct. 24
Nov. 6.	School building,	Providence, R. I.	Oct. 24
Nov. 6.	Tunnel sewer,	Waterbury, Conn.	Oct. 17
	Advertised, Eng. News, Oct. 17 to 31.		
Nov. 8.	Electric light bonds ($15,000),	London, O.	Oct. 10
Nov. 7.	Water-works system,	Lockport, Ill.	Oct. 24
	Advertised, Eng News, Oct. 24 and 31.		
Nov. 8.	Mud dredging (100,000 cu.yds.),	New York.	Oct. 24
Nov. 9.	Iron or steel bridge,	Iola, Kan.	Oct. 24
Nov. 9.	Steel trestle bridge,	Ventura, Cal.	Oct. 24
	Advertised, Eng. News, Oct. 24.		
Nov. 9.	Sewers,	Norwood, O.	Oct. 24
Nov. 11.	Street lighting,	Springfield, Ill.	Oct. 17
Nov. 11.	Electric lighting,	Union Springs, Ala.	Oct. 17
Nov. 11.	Paving bonds,	Youngstown, O.	Oct. 17
Nov. 11.	Sewers,	Toledo, O.	Oct. 24
Nov. 11.	County jail,	Port Lavacu, Tex.	Oct. 24
Nov. 11.	Pipe sewers,	South Bend, Ind.	Oct. 24
Nov. 11.	Brick paving,	South Bend, Ind.	Oct. 24
Nov. 12.	Swing bridge,	Hamilton, O.	Oct. 24
Nov. 15.	Swing bridge,	Abbeville, La.	Oct. 10
	Advertised, Eng. News, Oct. 10 to 24.		
Nov. 15.	Plans exposition bldgs.,	Nashville, Tenn.	Oct. 17
Nov. 15.	Sewer system,	Champaign, Ill.	Oct. 17
	Advertised, Eng. News, Oct. 17 and 24.		
Nov. 15.	Water-works system,	Honey Brook, Pa.	Oct. 24
Nov. 18.	Powder (580,700 lbs.),	Washington, D. C.	Oct. 24
Nov. 19.	State capitol,	Olympia, Wash.	Sept. 12
	Advertised, Eng. News, Sept. 12 to Oct. 31.		
Nov. 20.	Drainage canal work,	Chicago, Ill.	Sept. 26
	Advertised, Eng. News, Sept. 26 to Nov. 14.		
Nov. 20.	Steel bridge spans (3),	Mobile, Ala.	Oct. 24
	Advertised, Eng. News, Oct. 24 to Nov. 7.		
Nov. 20.	Macadam road (6 miles),	Woodbury, N. J.	Oct. 24
	Advertised, Eng. News, Oct. 24.		
Dec. 2.	Sewers (22 miles),	Mobile, Ala.	Sept. 19
	Advertised, Eng. News, Aug. 29 to Oct. 24		
Dec. 17.	Steel rails (4,000 tons),	Ottawa, Ont.	Oct. 24
Jan. 7.	Street ry. franchise,	New Orleans, La.	Oct. 17
No date.	Oil wells,	Alliance, O.	Oct. 24
"	Fire hose,	Naples, N. Y.	Oct. 24

RAILWAYS.

East of Chicago.

ARCADIA & BETSEY RIVER.—Chas. J. Starke, of Arcadia, Mich., writes us that 17 miles of this road, noted Oct. 10 as incorporated, has been completed from Arcadia to the Chicago & West Michigan Ry. The construction of the remaining four miles to Copemish, at the junction of the Toledo, Ann Arbor & North Michigan and the Manistee & Northeastern roads, is now under way. The capital for the building of the entire line has been secured, and all contracts let. B. D. Davidson, of Copemish, Mich., has the contract for grading. Pres., Henry Starke, Arcadia, Mich.; Ch. Engr., John A. Mitchell, Ludington, Mich.

BURLINGTON & HINESBURG.—Frank O. Sinclair, Ch. Engr., Burlington, Vt., informs us that the construction of this road, noted last week, was commenced on Oct. 20. Asst. Engr., G. S. Leavenworth, of Charlotte, Vt.—Our local correspondent calls attention to the fact that the charter of the company expires in December if no grading has been done, and states that the work has been commenced seven miles from Burlington at the only point where right of way has been secured.

CENTRAL OF NEW JERSEY.—It is reported that an extension from Bound Brook, N. J., to Chimney Rock, six miles, will be commenced at once.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—According to press reports surveys are now being made for an air line route between Dayton, O., and Indianapolis, Ind.

HAMMOND & BLUE ISLAND.—The construction of the belt line from Hammond, Ind., to Blue Island, Ill., seven miles, has been commenced by C. W. Hotchkiss, contractor. The directors of the company are all connected with the packing firm of G. H. Hammond & Co., and it will doubtless be operated in the interests of that company, although it is reported that a fine passenger equipment will be placed on the road, and a belt line service transfer inaugurated in connection with the various lines which will be crossed. Pres., Jesse P. Lyman; Vice-Pres., K. H. Bell, both of Hammond, Ind.

JEROMESVILLE.—We are informed by H. B. Camp, of Akron, O., that this company has not yet been organized, but that 14 miles of the road has been completed and is now in operation for freight service. The line extends from Shreve, Wayne county, on the Pennsylvania road, to Jeromesville, passing through the Mohican Valley. No further construction is at present contemplated.

LONG LAKE.—The preliminary survey for this road, whose incorporation was noted in our issue of July 11, has been completed. It is projected to extend from Axton to the northern end of Long Lake. Engrs. in Charge, J. S. Mott & Son, Tupper Lake, N. Y.

MARIETTA TERMINAL.—R. L. Nye, Secy., Marietta, O., writes us that this is a reorganization of the Union Terminal Co., the property of which was recently sold on foreclosure and is now controlled by the new company. No extension of line is at present contemplated. Pres., T. D. Dale, Marietta, O.

MICHIGAN & OHIO BELT LINE.—C. G. Sweet, Secy., of Pioneer, O., writes us that the projected length of this road is 190 miles, from Grand Haven, Mich., to Lima, O., through the towns of Grand Rapids, Battle Creek and Coldwater, Mich., Pioneer and Defiance, O. Surveys and maps have been completed and nearly all of the right of way from Grand Haven to the Wabash road has been secured. Capital for construction is in hand, and contracts will be let as soon as right of way has been obtained. Pres., J. W. Boynton, Grand Rapids, Mich.; Ch. Engr., C. M. Rich, Grand Rapids.

NEW YORK CENTRAL.—Dr. W. S. Webb has awarded the contract for widening the embankments on the St. Lawrence & Adirondack division to D. C. Hanfield, of Brooklyn. The work is to extend north from Malone to the Canadian boundary, and it is the intention to make that portion of the road as substantial as the remainder of the line.

PATTEN & SHERMAN.—A. A. Burleigh, Pres., Houlton, Me., writes us that surveys for this road are complete, and that most of the right of way has been secured. The route is from Patten to Sherman on the Bangor & Aroostook, via Crystal, 5½ miles. Capital for construction has all been secured, and a force of workmen has been engaged in clearing and grading since Oct. 1. The construction work is being done by the railway company, no contracts being let. Ch. Engr., J. C. Boyd, Patten, Me.

PENNSYLVANIA.—Chas. McFadden, Jr., of Philadelphia, has been awarded the contract for the completion of the first division of the new Bustleton branch, 3½ miles in length, which will join the main line near North Penn Junction. The original contract for the construction of the branch was awarded to the father of Mr. McFadden, now deceased, who was engaged on the work when the financial depression caused a suspension of operations.

PITTSBURG, MONONGAHELA & WHEELING.—According to press reports, the contract for the construction of this road has been let to Joseph Gianni, and active work is to begin at once. The terminus of the new line will be on the Monongahela River, opposite Monongahela, at which point connection will be made with the Pittsburg & Erie Ry. Crossing the river, the road will follow Pigeon Creek and Ten-Mile Creek valleys until a straight route to Wheeling is practicable. Pres., Wm. G. Dacey, 40 Wall St., New York city; Ch. Engr., A. D. Weeld; General Counsel, J. H. McCreery, Pittsburg; office, 303 Germania Bank Bldg., Pittsburg, Pa.

RACKET RIVER.—J. S. Mott & Son, of Saratoga Springs, N. Y., who have the construction of this road in charge, write us that the preliminary survey has been completed and the location of the line well under way. It is proposed to construct about 3½ miles this fall. The projected length is 20 miles, from Potsdam, St. Lawrence county, through Pierpont to Colton, with a branch at or near Hannawa Falls to Parrishville.

TERRE HAUTE & MISSISSIPPI.—Herman Hulman, of Terre Haute, an incorporator, writes us that no steps in the direction of active work will be taken until subsidies have been voted by Terre Haute and the townships along the proposed route. No surveys have been made.

Southern.

ALABAMA NORTHERN.—Incorporated in Alabama, according to a press report from Montgomery, to build a railway from Florence, Ala., northward to the state line; capital stock, $3,000,000; incorporators, Geo. P. Jones, R. J. Simpson and R. T. Simpson, Jr., all of Florence.

BELINGTON & LITTLE LAUREL.—The contract has been awarded for the grading of this road from the intersection of the West Virginia Central & Pittsburg and the Charleston & Roaring Creek roads, to Belington, W. Va., 10 miles. Tracklaying will soon commence. The headquarters of the projectors of the enterprise are at Belington, W. Va.

CAPE FEAR & YADKIN VALLEY.—This North Carolina road 306 miles in length and extending nearly across the state, from Mt. Airy, in the Blue Ridge Mountains, to Wilmington, on the sea coast, via Greensboro and Fayetteville, is soon to be sold to satisfy a mortgage judgment. An effort is being made by New York parties to have the three divisions sold separately, in opposition to the recommendation of the Baltimore bondholders' committee, which has formulated a plan for reorganization. It is stated that both the Baltimore & Ohio and the Southern Ry. are seeking to obtain control of the property. Our correspondent at Raleigh writes us that it is the opinion of the principal stockholders in that state that the Southern Ry. will acquire the property and make a through line from Wilmington to Roanoke, Va., through the lease or purchase, also, of the Roanoke & Southern Ry., 102 miles, from Winston, N. C., to Roanoke, that road and the Cape Fear & Yadkin Valley connecting near Winston at present. If the Baltimore & Ohio purchase the road, it will build a connecting link from Lexington, Va., the present southern terminus of the system, to Roanoke.

CHESAPEAKE, WEST VIRGINIA & WESTERN.—Incorporated in West Virginia, to build a railway from Frost to Parkersburg; capital stock, $100,000, commencing with $5,000; incorporators, W. E. Chilton; G. O. Chilton, C. M. Galleher, B. McDonald and F. H. Scott, all of Charleston, W. Va.; principal office, Charleston, W. Va.

LAFAYETTE.—G. E. McGehu, Pres., Lafayette, Ala., writes us that virtually the entire right of way has been secured, and that contracts for grading and building have been let. The route is 22 miles in length, from Opelika via Oak Bowery to Lafayette. The equipment is yet to be bought, and bids are asked for one 25 or 30-ton locomotive, 2 passenger coaches and 4 box cars. Ch. Engr., Jno. L. Cowan, Opelika, Ala.

MONONGAH & OHIO RIVER.—M. Newberger, of Parkersburg, W. Va., writes us that the surveys of the 54 miles of projected length of this road have been made. No organization has yet been effected. Articles of incorporation were filed Sept. 13, and noted in our issue of Sept. 19.

MONTGOMERY, HAYNEVILLE & CAMDEN.—John A. Milner, Ch. Engr., Birmingham, Ala., informs us that surveys have been completed and right of way all secured. The road is to extend from Montgomery to Camden, a distance of 73 miles, through the towns of Hayneville, Gordonville and Furman. No contracts have yet been let, as the capital for construction has not all been secured. Pres., Sol. D. Bloch, Camden, Ala.

NASHVILLE & MISSISSIPPI DELTA.—H. L. Underwood, Secy., Birmingham, Ala., informs us that all the right of way from Okolona to Grenada has practically been secured by deed, but that active work upon the proposed line has been postponed until the meeting of the next Mississippi legislature, when an effort will be made to strengthen the charter.

VIRGINIAS'.—According to a press report, this is the new name of the proposed Columbus, Huntington & Guyandotte River road. At a meeting of stockholders, held Oct. 17, it was decided to increase the capital stock to $7,500,000, and a new board of directors was chosen. Pres., C. W. Smith, Chicago; Secy and Treas., Robert Avery, New York; Asst. Secy., C. W. Campbell, Huntington, W. Va. The intention of the new organization is to build at once.

WEST VIRGINIA SOUTHERN.—R. T. Herndon, Pres., Charleston, W. Va., writes us that seven miles of this road has been built, and that the remaining 83 miles will be completed within the next two or three years. Gouch, Rinehart & Co., of Covington, Va., have the construction work in charge. The capital for construction has all been secured. The road is to extend from Brownstown, W. Va., to Bramwell, W. Va., on the southern boundary of the state. Ch. Engr., K. G. Vance, Charleston, W. Va.

Northwest.

WISCONSIN & LAKE SUPERIOR.—Press reports state that the contract for building 40 miles of this road from London, Dane county, Wis., to Geneva Junction, Walworth county, has been let to Geo. A. Welch, of Chicago. It is thought that this line will be controlled by the Chicago & Northwestern Ry., since it will afford a short route for the through passenger traffic between Chicago and St. Paul, by way of Geneva Junction, Elkhorn, Whitewater, London and Cottage Grove, reducing the present distance 30 miles.

Southwest.

KANSAS CITY, PITTSBURG & GULF.—This company recently opened its line from Siloam Springs, Ark., to Stilwell, Ind. T., a distance of 30 miles. A press report states that the road will soon be extended from Stilwell to Salisaw, Ind. T., a distance of 25 miles. The main line will run 15 miles west of Fort Smith, and that city will be reached by a spur line. Another extension of the road, from Salisaw to Poteau, Ind. T., a distance of 30 miles, will be completed by Mar. 1. The road is being built north and south from Texarkana and Shreveport. It is expected that the entire line from Kansas City to the Gulf of Mexico at Sabine Pass, will be completed and running within the next twelve months. It will be 150 miles shorter than any other line to the Gulf.

ST. LOUIS, CAPE GIRARDEAU & FORT SMITH.—This company proposes an extension from Hunter, Mo., to Harrison, Ark., a distance of 125 miles. Ch. Engr., J. F. Brooks, of Cape Girardeau.

Rocky Mt. and Pacific.

DENVER & COLORADO SOUTHERN.—The incorporation of this company was noted last week. Press reports state that the project involves a combination of the Denver, Leadville & Gunnison, the Midland Terminal, and the Florence and Cripple Creek roads, with 32 miles of new line between the termini of the two first mentioned. From Denver to Symes, a third rail will be laid on the roadbed of the Denver, Leadville & Gunnison, which is a narrow gage road. From Symes the new line will be constructed along the Platte River and Trout Creek valleys to Divide, and from this place the tracks of the Midland Terminal will be used to Cripple Creek. This arrangement will give a route to Cripple Creek 60 to 70 miles shorter than any present route. The incorporators are said to be associates of David H. Moffat, Pres. First National Bank of Denver, who is extensively interested in the development of Cripple Creek.

Foreign.

MEXICO & ACAPULCO.—This railway company has been incorporated in Colorado for the purpose of completing the Mexican & Cuernavaca Ry. of Mexico, a road which has been some five years in building, and which is about one-half constructed. It begins at the city of Mexico and extends 40 miles toward Cuernavaca. There yet remain some 30 miles to build. The company has an authorized capital stock of $1,000,000. The incorporators are D. B. Smith, of Norristown, Pa.; Frank S. Reigart, of the City of Mexico; George L. Hodges, Charles Wheeler, and E. L. Shannon, of this city.

STREET AND ELECTRIC RAILWAYS.

BENNINGTON, VT.—It is stated that the Bennington & Rutland Ry. Co. is considering the question of changing its five-mile branch, from North Bennington to Bennington, from steam to an electric road.

AUBURN, N. Y.—It is stated that the C. W. B. F. & C. L. Traction Co. is about to construct a new power house at Cayuga Lake.

BROOKLYN, N. Y.—It is stated that the Brooklyn Heights R. R. Co. has decided to extend its system to Bergen Beach. The company will build a trolley line from its present terminal at Flatlands, along Island Ave., Avenue U and East 66th St., touching the water front 1½ miles distant. A real estate syndicate will erect a casino, lay out board walks and organize several novel amusement enterprises.

GLEN HAVEN, N. Y.—The Irondequoit Park R. R. Co. has been incorporated to build a street railway between Rochester and Glen Haven; capital stock, $100,000; directors, C. B. Woodworth, C. C. Woodworth, F. P. Crouch, Frank Taylor, and others, of Rochester.

LEWISTON, N. Y.—Paul Voorhees, Ch. Engr., 65-66 Chapin Block, Buffalo, writes us that surveys have been made and right of way obtained for the Lewiston & Youngstown Frontier Ry. Co.'s proposed electric road, six miles long. The capital for the construction has been secured, but no contracts have yet been let, as it is not probable that any work will be done until spring. Pres., L. Rumsey, Lewiston.

OSWEGO, N. Y.—The Oswego St. Ry. Co. has decided to raise its capital stock to $200,000, of which $75,000 will be used to erect a new power house and make a number of extensions to its electric road. Supt., F. E. Pritchard.

TROY, N. Y.—Martin Schenck, Pres., Troy, writes us that Reeves Smith, of Troy, has completed surveys for the Greenwich & Schuylerville Ry. & Power Co.'s proposed electric road, eight miles long, from Greenwich to Middle Falls and Schuylerville. The right of way has nearly all been secured. Arrangements for securing the capital for the construction have not been fully completed. It has not been definitely decided when contracts will be let.

AVALON, PA.—The Ohio Valley Electric Ry. Co. has been incorporated to operate a line from Avalon; capital stock, $175,000; Pres., W. B. Carson, of Pittsburg; directors, W. B. Howay, Wm. Hageman, Wm. T. Lindsay, H. E. Lineweather and Edgar C. Gerwig.

CORRY, PA.—The Corry Electric St. Ry. Co. has been organized with a capital stock of $18,000, $1,800 of which has been paid in; Pres., R. N. Seaver; Secy., C. P. Rogers, Jr.; Treas., D. L. Bracken; directors, R. N. Seaver, R. P. Dawson D. L. Bracken, T. A. Edwards, H. L. Gordon, Frank Laurie and F. A. Beebe.

PITTSBURG, PA.—Local papers state that the Knoxville & Arlington Ave. St. Ry. will be built this fall. Contractors are now bidding on the grading and laying of five miles of double track on the hill. It has been decided to issue $100,000 in bonds, which the Pittsburg & Birmingham Traction Co. will guarantee. These bonds will be put on the market in a few days. The street railway is backed by the Knoxville Land Improvement Co. J. C. White, one of the projectors of the Beaver Valley Traction Co., is interested.

WASHINGTON, PA.—The Washington & Canonsburg Ry. Co. has been incorporated to construct an electric railway seven miles long; capital stock, $75,000; Pres., Arthur Kennedy, of Allegheny; directors, Francis J. Forrauer, Thomas B. Hutchinson, L. H. Matthews, Wm. Beall; Marshall H. Reno. This company was noted under Railways last week, but Arthur Kennedy writes us that the road will be operated by electricity, the right of way for which is yet to be secured.

HAGERSTOWN, MD.—The Hagerstown & Potomac Electric Ry. Co. has been incorporated, with a capital stock of $200,000; incorporators, Dr. E. A. Wareham, Samuel H. Long, Edward Hoffman, Wyatt M. Keedy, Hagerstown; William Grier, Beers, and Frederick L. Snyder, of Pennsylvania.

WASHINGTON, D. C.—G. R. Abbot, Pres. and Gen. Man., 1416 F St. N. W., Washington, informs us that the contracts for the construction of the Washington, Alexander & Mt. Vernon Electric Ry., 25 miles long, has been let as follows: Engines, Providence Steam Engine Co., Providence, R. I.; electrical apparatus, General Electric Co., New York; rails, etc., Pennsylvania Steel Co., Steelton, Pa.; excavating, track and overhead work, Trask & Hildnell, of New York; tracklaying, etc., W. E. Saxton, of Washington. Ch. Engr., D. J. Howell, Alexandria.—F. H. Stiter, Engr., Hutchins Bldg., Washington, writes us that the Washington & Great Falls Electric Ry. Co. is now operating its line to the district line, a distance of four miles, and is at work upon an extension of three miles to Cabin John Bridge. Orders for rails have just been placed, and other materials and equipment will be contracted for as fast as possible.

BRUNSWICK, GA.—It is stated that the contract for constructing and equipping the Brunswick Electric St. Ry. has been awarded to Thos. V. Hale & Co., 712 Commercial Bldg., St. Louis, Mo.

LOUISVILLE, KY.—J. C. Wright, Secy., Louisville, writes us that surveys are being made for the Louisville, Mount Washington & Fairfield Ry. Co.'s proposed

electric road, 32 miles long, from Louisville to Fairfield. The right of way and about all of the capital for the construction have been secured. The company is ready to let contracts for the construction of the road, as it is desired to begin work at once. Pres., W. B. Hoke, Louisville; Ch. Engr., Rowland Cox, Taylorsville, Ky.; F. M. Lilly, Fairfield, director.

XENIA, O.—The Rapid Transit Co. has been incorporated to build an electric road between Xenia, Yellow Springs and Springfield, O.; capital stock, $300,000; directors, John Little, S. M. Allison, Marcus Shoup, J. W. Neff and W. R. Baker.

GREENWOOD, IND.—It is stated that Marston & Bracey, of Chicago, Ill., have been awarded the contract for building the Indianapolis, Greenwood & Franklin Electric Co., at about $275,000. Work begun last week, and the road to be completed by March 1.

RICHMOND, IND.—The construction of an electric road between this city and Connersville, at an estimated cost of $300,000, is being considered. L. V. Armstrong, C. C. Binkley and D. L. Mather are interested.

DETROIT, MICH.—It is stated that Isaac Bearinger and Fred Marvin, of Saginaw, Mich., are interested in a proposed electric railway between this city and Saginaw, estimated to cost about $4,000,000. W. H. Stevens and W. A. Jackson, of Detroit, are interested.

CHICAGO, ILL.—Local papers state as follows: The call for $1,000,000 made by the security holders of the Union Loop Co. has been met promptly. Construction operations on the Wabash Ave. loop will begin as quickly as the ordinance becomes a law. It is proposed to get the foundations in before the severe weather begins. The work of erecting the structure is to be continued through the winter. Estimates are now being made on the iron. The entire loop is to be equipped with electricity with the third-rail system. The rail will be put in as the road is built, and at less expense than is involved in the erection of the rail upon the Lake St. elevated structure. Nearly all of the material for the electrical equipment of the latter road, excepting the insulators, has been received. The movement of trains by electricity is expected to begin Feb. 1.

CHICAGO, ILL.—C. S. Leeds, of the Suburban R. R. Co., 100 Washington St., Chicago, writes us that the permanent organization of the company has not yet been perfected, although it has been in existence for six or eight months. The surveys are about completed, and the plans and specifications are about ready to be placed in the hands of contractors for bids. The line will start at the terminus of two of the elevated railways at the western limits of the city, and run in a southwesterly direction through the townships of Cicero and Proviso, touching the villages of Austin, Oak Park, Berwyn, La Vergne, Riverside, Grossdale and La Grange. The motive power will be electricity, and there will be approximately 13 miles of double-track road. The capital for construction has been secured, and it is expected to have the road in operation some time in the spring of 1896.

DANVILLE, ILL.—Washington T. Cunningham, Danville, writes us that about two-thirds of the right of way has been secured for the proposed Danville & Northwestern Electric Ry., 42 miles in length, between Danville, Paxton and Potomac. The capital for the construction has been promised, but it has not yet been secured. The contracts will not be let this fall. The charter contemplates a line to Gilman from Potomac, by way of Rankin and Cisna Park. The chief engineer has not yet been appointed. Pres., W. W. Hatch, of Goshen, Ind.

SUPERIOR, WIS.—Wm. Howensteine, of East End, Superior, is interested in a projected street railway the entire length of Minnesota Point.

WATERLOO, IA.—The Waterloo & Cedar Falls Rapid Transit Co. has been incorporated; capital stock, $600,000; incorporators, C. J. Fosselman and J. H. Bowman, of Waverly, Ia.; L. S. Case, of Sumner, Ia., and J. H. Rafferty, of Waterloo. Work on the line will not be commenced until spring.

FARGO, N. DAK.—C. G. Nickells, of Wahpeton, is reported as interested in a projected electric road to Moorhead, Minn.

KANSAS CITY, MO.—Willard E. Winner, Pres., Kansas City, Mo., writes us that the Electric Ry. Construction Co. has completed 10 miles of the Westport & Waldo Ry. Co.'s dummy road, 20 miles long, and the balance is under construction. Ch. Engr., W. H. Dunn, Kansas City, Mo.

ST. LOUIS, MO.—J. D. Houseman, Jr., of the Houseman Air Line, writes us that the right of way is being secured for an electric road 40 miles long to Brentwood, Mentor, Manchester, Pacific and other country towns in the vicinity of this city. Part of the road will be built in 60 or 90 days, and the balance of the road will be built in portions of 1½ miles from time to time, as the promoters have three years in which to complete the road. The line will connect at Brentwood with the St. Louis & Kirkwood R. R. The company has not yet been organized, nor has the capital for the construction been secured. Ch. Engr., E. A. Guill.

ST. JOSEPH, MO.—W. T. Van Brunt, Gen. Supt., writes us that the St. Joseph Traction & Lighting Co. is being reorganized. The proposed improvements to the line, estimated to cost about $500,000, have not yet been decided upon.

DENVER, COLO.—The Denver & Southwestern Ry. Co. has been incorporated, with a capital stock of $100,000, by F. J. Bancroft, E. H. Smith, F. D. Levering, John H. Denison and Alexander Berger. It is proposed to construct an electric railway within Arapahoe and adjoining counties. For the present the terminus of the road is to be at Morrison, and it will thread through the scenic places in that region of the foothills, and eventually run through the county in order to pick up the milk and dairy produce business, which is an important matter to freight departments.

ALBUQUERQUE, N. MEX.—Harry D. Johnson and Edward A. Pearson have been granted a franchise by the council for an electric railway.

MONTREAL QUE.—Press reports state as follows: The Canadian Electric Railway & Power Co. will apply for articles of incorporation at the next sitting of parliament to build a railway from Montreal to Windsor, running through Brockville, Kingston, Belleville, Toronto and London, with branch railways for a radius of 25 miles from the main line. The company also asks leave to lease all existing roads, to dispose of electricity for power or heating purposes, and to have full right to perform all undertakings of an electrical company. It is not stated in the application who the promoters are.

ELECTRIC LIGHT AND POWER.

BORDENTOWN, N. J.—We are informed that the Bordentown Electric Light & Motor Co., incorporated Oct. 3, with a capital stock of $50,000, as noted in our issue of Oct. 10, will make arrangements as quickly as possible for the construction of its plant. Pres. and Gen. Man., James S. Gilbert; Treas., Geo. B. Gilbert; Secy., Justin W. C. Steele; of Bordentown.

CATAWISSA, PA.—Chas. E. White, 411 and 413 Walnut St., Philadelphia, has been awarded the contract for an electric light plant at $7,520. S. S. Dreisbach, Chn. Com.

EAST MAUCH CHUNK, PA.—C. H. Lentz writes us that the citizens on Nov. 5 will vote on the question of building an electric light plant to cost $15,000.

OLIPHANT, PA.—Bids are asked until Oct. 25 for furnishing machinery for an electric light plant. M. W. Cummings, Jr., Secy. Council.

SANFORD, N. C.—J. C. Williams, of Sanford, is about to submit to the town a proposition for an electric light plant, bids for which may soon be asked.

ATHENS, GA.—An election will be held Oct. 26 to vote on the question of issuing electric light bonds.

CONOWINGO, MD.—It is stated that Oemesis Hershel 2 Wall St., New York, N. Y., has prepared plans for the proposed power plant for the Susquehanna River Electric Co., of this place.

ATHENS, GA.—An election is to be held Oct. 26 to vote on the question of issuing $15,000 in bonds for erecting an electric light plant. W. W. Turner, Cy. Clk.

DUBLIN, GA.—Albert R. Arnan, Cy. Clk., writes us that the city has had an engineer to make surveys and plans for an electric light plant and water-works, estimated to cost about $30,000. An election will be held to vote on the question of issuing bonds to that amount.

ROME, GA.—The O'Neill Mfg. Co. is about to put a 75 or 100-light dynamo in its factory.

ARCANUM, O.—Bids are asked until Nov. 6 for the purchase of an electric light franchise. Chas. Wittenmyer, Clk. Council.

COLUMBUS, O.—Chas. A. Knight, of Fort Wayne, Ind., writes us that plans will be furnished by the Fort Wayne Electric Corporation for the Citizens' Light, Heat & Power Co.'s proposed plant for this city. No definite information can be furnished yet, as the matter will have to be voted on by the citizens Nov. 5. The company was recently incorporated with a capital stock of $200,000 by R. T. McDonald, Fort Wayne, and Thos. Cooper and others, of Columbus.

DANVILLE, IND.—Press reports state that J. S. Richards, of Marshall, Ill., has closed a contract with the town board by which work is at once to begin on an electric light plant, the Thomson-Houston system to be used. About 20 arc lights will be put on the streets, and the old water-works plant and boilers will constitute the power house of the lighting plant.

WINAMAC, IND.—The town will be lighted with electric lights within 60 days, according to reports.

IRON MOUNTAIN, MICH.—It is stated that G. B. Pride has completed surveys for a proposed water-power plant at Iron Mountain and Republic, Mich., to be owned by John R. Wood, of Appleton, Wis.

ROCKFORD, ILL.—F. G. Hogland, Cy. Clk., writes us that the city is investigating the feasibility of owning the electric light plant, but no action has yet been taken, although it was reported in our issue of last week that the city had voted to build a plant.

UPPER ALTON, ILL.—Bids are asked until Nov. 4 for constructing an electric light plant and water-works, according to reports. P. S. Webster, Village Clk.

FERGUS FALLS, MINN.—The following bids have been received by M. R. Lowry, Cy. Clk., for constructing an electric light plant: Electrical Engineering Co., Minneapolis, $19,500; Jones & Winter, agent General Electric Co., Minneapolis, $16,365; Burtis & Howard, Minneapolis, $12,920; Western Electric Co., Chicago, Ill., $12,381; Fort Wayne Electric Corporation, Fort Wayne, Ind., $16,285. The above bids are for the electric light plant exclusive of building, water-wheel, shafting and main belt. The contract for the power house has been awarded to John Lawritzen, of Fergus Falls, at $2,665; the balance has not yet been awarded. Burtis & Howard will probably secure the construction of the electric light plant.

LESUEUR, Minn.—C. F. Loweth, of St. Paul, has been engaged to prepare plans for an electric light plant and water-works.

LA PORTE CITY, IA.—A. Van Valkenburg, Secy. and Treas., writes us that the Fort Wayne Electric Corporation, of Fort Wayne, Ind., has been awarded the contract for the electric machinery for the new Electric light plant, and that the contract for the power house, boilers, engine, pumps, etc., has been awarded to F. F. Vata & Co., of Minneapolis, Minn.

OGAMAW, ARK.—It is stated that the Hickok Lumber Co., of this place, is about to put in an electric plant of 150 lights.

PINE BLUFF, ARK.—Charles Weyl, J. M. Goga, and others, have been appointed a committee by the council to consider the feasibility of constructing an electric light plant, electric railway, and water-works for this place, which has a population of 15,000.

KERRVILLE, TEX.—Charles Schreiner, of Kerrville, writes us that he will erect an electric plant of 300 to 400 lights capacity, in about 90 days.

MARLIN, TEX.—It is stated that R. M. & J. M. Odell have been granted a franchise for an electric light plant and water-works.

NEW COMPANIES.—Lexington Electric Co., Kansas City, Mo.; $80,000; B. R. Kimball, E. G. Taylor, C. A. Burton, E. O. Marguis, D. M. Wolfe.

Sac City Electric Co., Sac City, Ia.; $15,000; D. C. Early, Asa Platt, D. E. Hallett, E. N. Baily, J. E. Robbins, W. Cheney, J. Y. Campfield.

Machine Electric Light & Power Co., Denver, Colo.; $100,000; J. S. Spencer, F. D. Taggart, H. J. Mayham. The company now holds franchises for lighting the towns of Erie, Louisville and Lafayette.

Lachine Rapids Hydraulic & Land Co., Montreal, Que.; $1,000,000; to generate power at Lachine Rapids; Thomas Pringle, William McLea Walbank, George Bull Burland, Jeffrey Hale Burland, Samuel Carsley, Montreal.

Lucas Electric Construction Co., Baltimore, Md.; $[illegible],000; to construct an electric construction business and deal in electrical supplies. J. Clarence Lucas, Rigaud; Merryman, Charles E. Burgan, Wm. V. Wilson, Jr., Wm. M. Burgan.

BRIDGES.

NEW HAVEN, CONN.—The committee has voted to direct the city engineer to prepare plans for a new drawbridge over the Quinnipiac River at Grand Ave. The committee is also reported as making arrangements to advertise for bids for the construction.

JERSEY CITY, N. J.—The contract for the 61-ft. span Melan bridge on Montgomery St., over Cornelison Ave., has been awarded to Clark & Co., Brooklyn, N. Y., at $10,250, the bridge to be completed in 45 days.

NEWARK, N. J.—At the election Nov. 5 a vote will be taken on the proposition to construct a bridge over the Passaic River at South Fourth St., Harrison, and Madison Aves., Newark. John Boyd, Clk. Freeholders.

ALLEGHENY, PA.—The following bids have been received for constructing the Woods Run viaduct, Allegheny; Engr., Harry J. Lewis:

Penn Bridge Co., Beaver Falls, Pa.	$18,950
Shiffler Bridge Co., Pittsburg, Pa.	16,930
Youngstown Bridge Co., Youngstown, O.	16,700
Pittsburg Bridge Co., Pittsburg, Pa.	16,490

BEAVER, PA.—The Ohio River Bridge Co. is reported to have about completed arrangements for awarding the contract for constructing its bridge. A. J. Jolly, John T. Taylor, of Monaca; Judge Hice, of Beaver; J. J. Hoffman and S. H. Moulds, of Rochester, Pa., and A. M. Lilly, of Beaver Falls, Pa., are interested.

NORRISTOWN, PA.—It is reported that the Grand Jury has approved the report of a jury of view recommending the erection of an iron county bridge, 40 ft. wide and 468 ft. long, over Stony Creek, in Norristown, to cost about $40,000.

PITTSBURG, PA.—Joseph Gianni has been awarded the contract for building the first section of the Pittsburg, Monongahela & Wheeling R. R., as noted under Railways. This section includes a bridge over the Monongahela River, with a 550-ft. channel span, and it is stated that 19 bridges will have to be built before the railway reaches Bentonville.

POTTSVILLE, PA.—The county commissioners have received bids for constructing bridges, as follows:

Ashland Bridge.

Variety Iron Works Co., Cleveland, O.	$2,690
Pottsville Bridge Co., Pottsville	2,530
Horseheads Bridge Co., Horseheads, N. Y.	1,764
Toledo Bridge Co., Toledo, O.	2,692
Nelson & Buchanan, Chambersburg, Pa.	1,780
King Bridge Co., Cleveland, O.	2,700
Massillon Bridge Co., Massillon, O.	2,625
Berlin Iron Bridge Co., East Berlin, Conn.	2,640
Wrought Iron Bridge Co., Canton, O.	2,650

Excavating and Stone Work.

Henry Litsch, Mahanoy City, Pa.	$3,049
Engelbert Schmicker, Ashland, Pa.	1,045
J. W. Schaeffer, Pinegrove, Pa.	4,500
Nich Brenner, Pinegrove, Pa.	880
F. A. Brenner, Pinegrove, Pa.	825
Freiler & Bradman, $3.65 per perch	1,033
Wolfgang & Schott, $5 per cu. yd.	1,124

Pinegrove Bridge.

Variety Iron Works Co.	$1,714
Horseheads Bridge Co.	1,170
Toledo Bridge Co., Toledo, O.	1,720
Nelson & Buchanan	1,340
King Bridge Co.	1,735
Massillon Bridge Co.	1,675
Berlin Iron Bridge Co.	1,720
Wrought Iron Bridge Co.	1,750

Stone Work and Excavating.

J. W. Schaeffer	$588
F. A. Brenner	785
N. Brenner	820

Tamaqua Stone Bridge.

Herman Riebe	$6,350
Philip Kellar, Tamaqua	*4,905
J. B. Ulrich	4,950
Henry Litsch	13,000
Christ Deizeit	8,000
J. P. Miller	8,016
N. Brenner	8,950

* Awarded contract.

NEW BERNE, N. C.—R. S. Neal, of Scotland Neck, was the lowest bidder, at $29,075, for constructing the bridges over the Neuse and Trent rivers, the structures to be 5,110 ft. and 2,575 ft., respectively.

MOBILE, ALA.—Bids are asked until Nov. 20 for constructing three steel bridge spans and approaches, as stated in our advertising columns. Consult. Engrs., Nicol & Ezzell, Mobile; Geo. E. Sage, Pres. Comrs.

MERIDIAN, MISS.—Bids are asked by the board of supervisors until Nov. 1 for building a bridge over Kernan's Branch. B. V. White, Clk. Bd.

CINCINNATI, O.—Bids are asked until Nov. 2 for constructing a new superstructure over Lee's Creek. Geo. C. Zimmerman, County Clk.——The engineer has prepared plans for the board of administration for the proposed viaduct, 1,500 ft. long, at Harrison and Western Aves., estimated to cost $150,000.

EAST LIVERPOOL, O.—Press reports state that the proposed new bridge over the Ohio here is likely to be built this winter. About $150,000 of the bonds have been taken, and that the contracts for the work all having been signed, there is now a prospect that work will begin on the piers and abutments soon.

HAMILTON, O.—Bids are asked by the county commissioners until Nov. 12 for constructing an iron or steel hoist or swing bridge, 60 ft. long and 20 ft. wide, over the Miami & Erie Canal; check, $2,000.

INDIANAPOLIS, IND.—Bids are asked until Oct. 29 for constructing a 78-ft. plate girder bridge, with two stone abutments, over Pleasant River at Meridian St.; the work includes 560 cu. yds. of earth excavations, etc.

BENTON HARBOR, MICH.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. has been petitioned to build a swing bridge over the Paw Paw River, instead of a stationary structure.

LA SALLE, ILL.—A correspondent writes us that the Illinois Central R. R. Co. is rebuilding its bridge in this city. The bridge consists of two 56-ft. plate

girders, one at either end of the structure, one 169-ft. span, 12 spans of between 157 and 159 ft. in length, one drawspan 182 ft. long, and two spans of about 169 ft. The two 56-ft. plate girders are new, and this season the company is replacing the 169-ft. span and five of the 157-ft. spans. The detailed drawings and plans of the work were prepared under the direction of J. F. Wallace, Ch. Engr., by the engineer of bridges, and the contracts let at so much per pound for the material delivered f. o. b. Chicago, the bridge department of the company doing its own erection. The steel work to be put up this year is being furnished by the Chicago Bridge & Iron Works. The entire cost of the renewal of the bridge, which will extend over a period of several years, is estimated at $150,000.

PEORIA, ILL.—Almon D. Thompson, Cy. Engr., writes us that J. A. L. Waddell, Keith & Perry Bldg., Kansas City, Mo., has been retained by the city to prepare estimates for a high and low bridge, report on which will be made in a few days. From another correspondent we are informed that in case the city decides to build, Mr. Waddell will prepare specifications and complete detail plans for the work.

SUPERIOR, WIS.—Plans are about completed for a foot-bridge 2,200 ft. long over the railway tracks. A. T. Thomas, Cy. Engr.

WINONA, MINN.—Fred H. Pickles, Consult. Engr., Winona, writes us that the following bids were received Oct. 10 for constructing a 43-ft. span stone arch bridge:

Chas. Butler (awarded contract)	$1,340
Winona Construction Co.	1,350
Thos. H. Botham	1,340
L. Coleman	1,657
John Degnan	1,498
Harden & Gatz	1,799
John Lohme	1,600
D. D. Smith*	1,619

* Minneapolis; all others of Winona.

DUBUQUE, IA.—Subscriptions are being secured for a bridge at Eagle Point to cost $135,000. W. H. Knowlton, Cy. Engr. M. M. Walker is interested.

GREENFIELD, MO.—Bids are asked until Nov. 5 for constructing a 215-ft. iron bridge over the Sac River. Benjamin Freedle, Bridge Comr.

ALEXANDRIA, S. DAK.—Bids are asked until Nov. 9 for constructing a 54 and 66-ft. span bridge. E. I. Gregory, County Audr.

BROOKINGS, S. DAK.—J. T. Nelson, County Audr., informs us that bids have been received for the following bridge work:

		40 ft.	60 ft.
Bergoin & Lawshe, Brookings:			
Own plan	Wood.*	$315.00	$490.00
Plan on file	Wood.	450.00	610.00
N. M. Stark & Co., Des Moines, Ia.:			
Plan on file	Wood.	518.00	685.00
Plan A	Iron.	749.00	1,069.00
Plan B.	Iron.	570.00	900.00
Wis. Bridge Co., Milwaukee	Iron.	796.00	1,196.00
Chicago B. & I. Co., Chicago.	Iron.	768.00	1,084.00
King Bridge Co., Cleveland, O.:			
Plan on file	Wood.	500.00	650.00
Plan No. 1.	Iron.	620.00	975.00
Plan No. 2.	Iron.	550.00	650.00
S. M. Hewitt & Co., Milwaukee	Iron.	700.00	1,000.00
Plan on file.	Wood.	510.00	670.00

* Awarded contract for two wooden bridges.

IOLA, KAN.—Bids are asked until Nov. 9 for constructing a 40-ft. iron or steel bridge over Big Creek. E. D. Lacy, Chn. Bd. Supervisors.

VENTURA, CAL.—Bids are asked until Nov. 9 for constructing a steel trestle bridge, estimated to cost $6,000, over Harmon Barranca, on the county road between Montalvo and Saticoy, as stated in our advertising columns. Geo. C. Power, County Surv.; A. S. Kenagy, Clk. Bd. County Supervisors, Ventura.

ST. JOSEPH, MO.—The construction of a viaduct in South St. Joseph, estimated to cost $10,000, is being considered.

BUILDINGS.

BOSTON, MASS.—Bids are asked until Oct. 26 for constructing additional cells to the house of industry, Deer Island. Archs., Winslow & Wetherell, 3 Hamilton Place, Boston; Alfred B. Heath, Comr.

BOSTON, MASS.—Plans are being prepared as follows: By Andrews, Jacques & Rantoul, 8 Beacon St., for a $400,000 warehouse, for Murray, Howe & Co.; by Winslow & Wilherell, 120 Tremont St., for a $275,000 hotel, for C. V. Colting, Parker House; by Bull & Dabney, 7 Park St., Boston, for a $175,000 office building, for E. B. Reed.

PITTSFIELD, MASS.—Pierce & Brun, 114 Fifth Ave., New York, N. Y., are preparing plans for a $130,000 school building for this city.

PROVIDENCE, R. I.—Bids are asked until Nov. 6 for constructing a high school building at Summer and Pond Sts. Archs., Martin & Hall, 502 Industrial Trust Co. Bldg., Providence; David Burton, Chn. Com., City Hall.

NEW HAVEN, CONN.—The jail committee has received the following bids for the ironwork for an addition to the jail:

Van Dorn & Co., Cincinnati, O.*	$30,000
McLagon Foundry Co., New Haven	27,700
Dean & Westbrook, New York	31,400
Berlin Iron Bridge Co., East Berlin, Conn.	33,110
Yale Safe & Iron Works, New Haven	33,200

*Awarded contract.

NEW YORK, N. Y.—Post & McCord, of New York, were the lowest bidders, at $419,900, for the iron and steel work for six stories of the U. S. warehouse in this city.——The trustees of the Townsend Estate propose to erect a 12-story building, 134 × 95 ft., at Broadway and 25th St., at an estimated cost of $800,000. Arch., Cyrus L. W. Eidlitz, 160 Fifth Ave.——Plans are being prepared for a 20-story office building at Nassau and Fulton Sts., for A. A. Raymond.——J. Munckowitz, 247 West 125th St., has prepared plans for a $125,000 hotel at St. Nicholas Ave. and 118th St., for T. F. White, 71 Lenox Ave.——Plans have been filed by John Kehoe, 335 East 15th St., for a seven-story brick warehouse at West and Vestry Sts., to cost $100,000.

PHILADELPHIA, PA.—Bailey & Truscott, 138 South Fourth St., Philadelphia, have prepared plans for a $200,000 office building, for the "Ladies' Home Journal."——New bids are to be asked for the construction of a new building for the Presbyterian Publication Society, at Juniper and Walnut Sts., estimated to cost about $350,000. Arch., Joseph M. Houston.

PITTSBURG, PA.—Plans are asked until Nov. 1 for a 20-room school building on Margaretta St., East End. D. A. Stevens, Secy. School Bd., Union Station.

PITTSBURG, PA.—Plans and arrangements are being made by the Pennsylvania R. R. Co. for a new depot on Grant Boulevard. Robt. Pitcairn and C. L. Magee are interested.

WILMINGTON, DEL.—Work may be commenced this year on the new car shops of the P. W. & B. R. R. Co., at Edgemoor. It is said the new shops will cost about $600,000, and that eventually the works now in Wilmington will be abandoned, or devoted to some other purpose.

BALTIMORE, MD.—Bids are asked until Nov. 4 for constructing a school building at Patterson Park Ave. and Biddle St. J. T. Oster, Inspector of Bldgs.

WASHINGTON, D. C.—The supervising architect received the following bids Oct. 15 for the roof covering, skylights, drain pipes, etc., for the post office building at Washington, D. C.:

	Total.	Time.
John J. Harrington, Washington	$58,699	4 months
Jacob Freund Roofing Co., Cincinnati	63,777	4 "
John Pierce, New York, N. Y.	56,540	100 days
Frank Baldwin, Washington	69,465	4 months
C. Thomas & Son, Washington	68,900	4 "
John Byrd, Philadelphia, Pa.	71,589	3½ "
John A. Miller & Bro., Chicago, Ill.	66,986	4 "
Manning & Parsons, Washington	65,565	100 days

HUNTINGTON, W. VA.—Chas. B. Moses, Chicago, Ill., has been awarded the contract for erecting the new court house at $97,650.

CONNELLY'S SPRINGS, N. C.—The stockholders of the Connelly's Springs Hotel Co., of this place, will make a number of improvements and additions to the property this winter.

RALEIGH, N. C.—The Agricultural & Mechanical College, of this city, has awarded a contract for putting a heating apparatus in the buildings to Allen & Cram, of Raleigh, at about $10,000. Blake & Williams and E. Rentz, both of New York, N. Y., were the other bidders.

CLEVELAND, O.—The school council has voted to construct five new school buildings at once.

YOUNGSTOWN, O.—The Erie system has had plans prepared for a passenger station, to cost about $75,000.

INDIANAPOLIS, IND.—Elam & Miller, Indianapolis, have prepared plans for a $500,000 office building, according to reports.

CHAMPAIGN, ILL.—D. H. Burnham, The Rookery, Chicago, has prepared plans for a $150,000 library building for the University of Illinois.

CHICAGO, ILL.—Bids are asked until Oct. 28 for boilers, steam heating and ventilating apparatus for the Chicago Isolation Hospital. W. D. Kent, Comr. Pub. Wks.——It is stated that the Northwestern University is preparing to erect a $1,000,000 office building next the old Grand Pacific Hotel at Jackson, Quincy, La Salle and Clark Sts. Lorin C. Collins and L. Z. Leiter are interested.

LYONS, ILL.—The scheme for building a railway clearing house at Lyons has been revived by the railway companies interested. As outlined, the plans provided for yards, which should cover an area of 1,300 acres. The project had advanced to the point that $1,000,000 had been expended in its carrying out, when the panic and its influence caused a cessation of the work. At the annual meeting of the board of directors of the company, held recently, a committee was appointed to take some action to renew the interest in the scheme. This committee is composed of J. M. Whitman, of the Chicago & Northwestern Ry. Co.; J. T. Harahan, of the Illinois Central R. R. Co., and James McCrea, of the Pennsylvania R. R. Co.

PARK RIDGE, ILL.—Bids are asked until Oct. 29 for constructing a village hall and water-works building. Arch., A. J. Carstens, 188 East Washington St., Chicago; Joseph Malone, Village Clk.

MILWAUKEE, WIS.—Bids are asked until Oct. 28 for constructing a brick building, 100 by 50 ft., to cost $100,000, for the Joseph Schlitz Brewing Co. Arch., Chas. Kirchhoff.

ST. LOUIS, MO.—Plans have been completed for a 17-story office building at Ninth and Chestnut Sts. R. Griffith, of Denver, Colo., and J. L. D. McCarthy, of the McCarthy Architectural & Engineering Co., St. Louis, are interested.

MOUNT PLEASANT, TEX.—Bids are asked by the county clerk until Nov. 4 for building a court house.

PORT LAVACA, TEX.—Bids are asked by the commissioners' court until Nov. 11 for constructing a county jail. T. H. Clement, Clk. Court.

WATER-WORKS.

NORTHFIELD, VT.—G. R. Andrews is reported to have purchased a water supply and as about to lay pipes through the village.

MERIDEN, CONN.—The city engineer has made surveys for a new reservoir. The construction will require a dam 30 to 40 ft. high and about 350 ft. long. The work has not yet been decided upon.

WILLIMANTIC, CONN.—The mayor has been authorized to purchase a carload of 6-in. pipe for extensions.

AKRON, N. Y.—The citizens have voted, 111 to 41, in favor of constructing works, to cost about $20,000.

BOONVILLE, N. Y.—It is reported that D. A. Harris, of New Britain, Conn., has selected a water supply for this village, and that there is talk of constructing works.

CORNWALL, N. Y.—A special meeting was held Oct. 22 to vote on the question of extending the mains from the corporation line to the Storm King clubhouse. Chas. A. Wood, Clk. Comrs.

CASSADAGA, N. Y.—The residents of this place are reported as agitating the question of works.

JOHNSTOWN, N. Y.—The water commissioners have purchased an additional water supply.

ONEIDA, N. Y.—J. E. Bremet, Clk., writes us that surveys are now being made by the Stanwix Engineering Co., of Rome, for extensions to the old plant of the Warner Water-Works Co., which was purchased by the village in September.

PHILADELPHIA, N. Y.—The contract for constructing works has been awarded to A. F. Nims, at $20,300. Scripture & Morris, of Watertown, N. Y., submitted the only other bid for a complete plant.

RANDOLPH, N. Y.—Chas. C. Sheldon, Supt., writes us that the contract for constructing a reservoir has been awarded to Silas L. King, of Randolph, at $2,710; the other bidders being Rogers & Ryan, Tonawanda, $2,791, and R. T. Lain & Co., of Bradford, Pa., at $3,475.

RIPLEY, N. Y.—E. A. Wilder, of Fredonia, is reported as making surveys for works for the Ripley Water Supply Co.; estimated cost, $17,000.

THERESA, N. Y.—The contract for constructing works at this place, for which bids were received Oct. 18, has been awarded to A. F. Nims, at $16,398. Scripture & Morris, of Watertown, bid $16,875. The plant will include a Worthington pump and a stand-pipe.

CAMDEN, N. J.—The city received 11 new bids Oct. 17 for a pure water supply of 15,000,000 or more gallons a day, nearly all of the bidders submitting several propositions. The Philadelphia Filter Co. offered to put in a horizontal filter system, using the Delaware River water, for $250,000; the U. S. Purifying & Filtering Co., of Philadelphia, a filter plant for $197,000; Continental Filter Co., of New York, $230,000, or $15 per million gallons up to 175,000,000 gallons a day and $13 above that amount; Isaac Doughten offered to sell the right to use a system of filtration for $20,000, the buildings to cost about $100,000; Morison-Jewell Filtration Co., $150,000 for a filter plant; several propositions were received from Dr. J. Orlando White, representing a company, offering a supply from the Rancocas Creek and basin, and propositions were received for an artesian supply from Geo. Pfeiffer, the Wagner Water Supply Co., and from C. L. Parker; F. C. O'Reilly and F. Lindwood Garrison, both of Philadelphia, offered plants to cost between $500,000 and $600,000 each, with a filtered supply from the Delaware River.

BELLWOOD, PA.—The Pennsylvania R. R. Co. is reported to have commenced the construction of a large reservoir at this place.

CONNELLSVILLE, PA.—The Yough Water Co. was incorporated Oct. 16 with a capital stock of $5,000, all paid in, to supply water in this township. Treas., J. C. Church, of Connellsville.

ELIZABETH, PA.—J. F. Cockburn, Pres. Elizabeth Water Co., writes us that the new works will cost about $45,000, and will include Laidlaw-Dunn-Gordon pumps, Ludlow hydrants and valves, and a reservoir. Engr., C. M. Clay, Duquesne, Pa.

GREENSBURG, PA.—The Westmoreland Water Co. is said to contemplate the construction of a large reservoir next summer, estimated to cost from $150,000 to $200,000.

HANOVER, PA.—The Consumers' Water Co., of Hanover, was incorporated Oct. 16, with a capital stock of $60,000, commencing with $6,000. Treas., Howard E. Young, Hanover.

HONEY BROOK, PA.—Bids are asked until Nov. 15 for constructing gravity works. A. M. Anderson, Borough Secy., writes us that the plant will include 9,000 ft. of 8-in. pipe, 4,250 ft. of 6-in., and 2,500 ft. of 4-in. pipe, 20 hydrants, 34 valves and a large reservoir.

MONTOURSVILLE, PA.—The council has selected a site for a new pumping station to cost about $3,000, and has contracted with E. Keeler & Co., of Williamsport, for a Knowles pump and boiler to cost $1,230. A well 14 ft. in diameter and 25 ft. deep will be dug.

NORRISTOWN, PA.—The Suburban Water Co. is reported to have contracted for 350 tons of crushed stone to be used in the construction of a reservoir near Valley Forge. It is stated that the company has secured a franchise covering considerable territory, and that within a year several villages will be supplied.

WINTON, PA.—J. F. Cummings, Borough Secy., writes us that the council has contracted with the Olyphant Water Co. for all hydrants on its line and with the Moosic Mountain Water Co. for hydrants on its line, the bid of each company being $20 each for Wood hydrants and $30 a year a hydrant for water.

CUMBERLAND, MD.—The superintendent writes us that the water commissioners are considering three propositions for a filter plant, two for mechanical filters and one for a natural sand gravity filter, but that no decision has yet been made. It is probable that the item in our issue of Oct. 3 under Cumberland, W. Va., should have been credited to this place.

DUBLIN, GA.—Albert R. Arnau, Cy. Clk., writes us that plans have been prepared for a water-works and electric light plant estimated to cost $30,000, but that the construction has not yet been voted upon by the citizens.

MARIETTA, GA.—A press report states that this city will soon have water-works.

ST AUGUSTINE, FLA.—F. W. Bruce has been engaged to make preliminary estimates for the new works.

WEST POINT, MISS.—At an election Oct. 14 the citizens voted, 121 to 15, in favor of issuing $20,000 in bonds for works.

TRENTON, TENN.—The council is reported to have accepted a proposition for the construction of works.

HUSTONVILLE, KY.—Efforts are being made to organize a company to construct works.

BLUFFTON, O.—Will A. Triplett, of the water committee, writes us that at the election Oct. 21 the citizens voted 255 to 27 in favor of works; no other steps yet taken; population, 1,500.

HIRAM, O.—Edwin L. Hall, Clk., writes us in addition to his letter published Oct. 3 that Hiram College has decided to put $5,000 into the plant and that a meeting of the citizens will soon be held to consider the proposed issue of bonds for the construction of the works.

LORAIN, O.—Bids are asked until Oct. 29 for laying 400 ft. of 12-in. main across Black River; also for laying about 1,100 ft. of 12-in. and 7,500 ft. of 6-in. pipe in the streets. F. C. Norcross, Supt.

TIFFIN, O.—The Tiffin Water Co. has contracted with the Holly Mfg. Co. for a new 4,000,000-gallon pumping engine. The present machinery consists of a Holly-

Gaskill engine of 3,000,000 gallons daily capacity and a Holly quadruplex pump of 1,500,000 gallons.

EVANSVILLE, IND.—Louis Weinheimer, Clk. Bd., writes us that the contract for cast iron intake pipe, as advertised in Engineering News, has been awarded to Eichel, Arnold & Co., of Evansville, at $24,900, to be completed in 150 days. The contract for a pump well, etc., also advertised in this paper, was awarded to the same firm, the bids being as follows:

	Brick.	Concrete.	Mas'y.	Days
Sooysmith & Co., New York	$161,000	$160,000	$161,000	270
A. McMullen & Co., New York	113,000	108,000	114,000	320
Christie & Lowe, Chicago, Ill.	89,900	87,100	85,800	150
Pearce & Morgan, Indianapolis	123,000	123,500	123,500	240
Eichel, Arnold & Co., Evansville	71,900	69,900	78,900	150

MIDDLETON, IND.—J. W. Farell, Cy. Clk., writes us that Tony Heffel, of Muncie, Ind., is preparing plans for the proposed works in this city. Population, 2,000.

RENSSELAER, IND.—The town board is reported as considering a proposition granting a franchise for the construction of works to cost about $40,000.

WALKERTON, IND.—It is reported that steps are being taken to secure works.

CORUNNA, MICH.—It is reported that the question of issuing $35,000 in bonds for a water-works and electric light plant will be voted upon Oct. 24.

MOUNT CLEMENS, MICH.—Spencer J. Dalley, Cy. Clk., writes us that as soon as estimates are made the question of constructing works will be submitted to a vote of the people; proposed supply from Lake St. Clair; population, 6,000.

OLIVET, MICH.—We are informed that a committee has been appointed to investigate the question of works and to report in February next. The village engineer is now making surveys of the village. K. D. Keyes is a member of the committee. Edwin Clark, Village Clk.

WAKEFIELD, MICH.—It is stated that bonds will be issued for the construction of works.

CHENOA, ILL.—Bids are asked until Nov. 4 for furnishing pipe, hydrants, etc., and for trenching and pipelaying. Geo. C. Morgan, Engr., Chicago. Fritz Ramsdorf, Cy. Clk.

CHICAGO, ILL.—Bids are asked until Oct. 28 for laying service pipes in nine streets, and until Oct. 29 for laying water mains in 15 streets. W. D. Kent, Comr. Pub. Wks.

FRANKLIN GROVE, ILL.—John Blocher, Village Clk., writes us that Chas. C. Jacobs, of Amboy, Ill., is preparing plans for works. After these are completed the question of construction will be voted upon. Address R. D. Morgan.

LOCKPORT, ILL.—Bids are asked until Nov. 7 for constructing works, as described in our advertising columns. W. S. Shields, Engr., Chicago; Leon McDonald, Pres. Bd.

TURNER, ILL.—D. Cahern, Clk., writes us that at an election Oct. 15 the citizens voted to issue $10,000 in bonds for works.

UPPER ALTON, ILL.—Bids are asked until Nov. 4 for constructing works and an electric light plant, according to a press report. P. S. Webster, Village Clk.

SPARTA, WIS.—We are informed that the water-works plant at this place is about completed. W. F. Wagner was the contractor.

WATERTOWN, WIS.—Wm. F. Voss, Secy., writes us that the contract for constructing works, as advertised in Engineering News, has been awarded to W. H. Wheeler & Co., of Beloit, Wis, at $89,421. A large number of bids were received.

WAUWATOSA, WIS.—The citizens have voted to issue $40,000 in bonds for works.

CENTERVILLE, IA.—The "Citizen" of this place states that plans for works have been completed and that the Aurora Iron Works is building the stand-pipe.

DOWS, IA.—The citizens have voted in favor of constructing works.

SIOUX CITY, IA.—The city engineer is reported as stating that new pumps, an additional reservoir and larger water mains are needed.

MOUNT VERNON, IA.—It is reported that the question of constructing works will soon be voted on.

GROVE CITY, MINN.—J. N. Gayner, Village Recdr., writes us that the contract for constructing works has been awarded to Fairbanks, Morse & Co., of St. Paul, at $5,185; population, 328.

LESUEUR, MINN.—C. F. Loweth, of St. Paul, has been engaged to prepare plans and superintend the construction of works and an electric light plant. J. F. McCarthy, of St. Paul, has the contract for the artesian well.

FARGO, N. DAK.—A. O. Rupert, Cy. Audr., writes us that nothing will be done in regard to a filter plant before spring. The proposed issue of $30,000 in bonds is for extensions to the water mains and sewers.

HASTINGS, NEB.—An election will soon be held to vote on an issue of $10,000 in bonds for a deep well and other improvements.

MARLIN, TEX.—R. M. Odell, J. M. Odell and others of Austin are reported to have contracted to construct works and an electric light plant at this place.

MOUNT VERNON, WASH.—The city clerk writes us that bids will probably be received in December for the construction of works, which will call for about 12,000 ft. of pipe, 12 hydrants, reservoir, pump and boiler, and will cost about $14,000.

HOLLISTER, CAL.—A press report states that the Hollister Water Co. awarded a contract Oct. 10 for the construction of a $50,000 water-works system. The supply will be secured about 12 miles distant, and the fall of 700 ft. is expected to generate electricity for lighting and power purposes.

SANTA BARBARA, CAL.—The Santa Barbara Water Co. has completed preliminary surveys and investigations for an increased water supply. The work will consist of the construction of a masonry dam 100 ft. high at the Juncal, near the headwaters of the Santa Ynez River, the laying of about 15 miles of 20-in. pipe, the driving of 7,000 ft. of tunnel through the Santa Ynez Mountain, and the erection of a power plant. The enterprise will provide not only an abundant water supply for the city, but also water for irrigating adjacent lands and power for transportation and lighting purposes. Engr., Ernest J. S. Purslow, of Santa Barbara.

KASLO, B. C.—The Kaslo "Claim" is agitating the construction of municipal works.

MOUNT FOREST, ONT.—It is reported that plans are being prepared for works estimated to cost about $26,000.

IRRIGATION.

WICHITA, TEX.—Press reports state as follows: J. W. Eubank, Engr., who has had charge of the work making soundings of the Brazos River for the location of the dam for the Wichita Valley Irrigating & Promoting Co., has submitted a favorable report to Secretary C. J. Green, which will make the construction of the dam over $100,000 less than former estimates. Work on the permanent survey for the ditch will commence at once.

O'NEILL, NEB.—The construction of an irrigation ditch in Holt county is proposed. The ditch is to draw water from the Niobrara and Snake rivers, in Cherry county, near Valentine. M. F. Harrington, of O'Neill, is interested.

HOLLISTER, CAL.—Final surveys are being made for the San Lorenzo Water Co.'s proposed irrigation system at Kings City, Monterey county. This company was incorporated about Oct. 5, with a capital stock of $300,000, for the purpose of constructing a storage dam on the San Lorenzo River, about five miles from Kings City. The height of the dam will be 100 ft., and will impound sufficient water to irrigate about 15,000 acres of level and fertile land in the vicinity of Kings City. Wm. K. Brown, Engr.; John L. Gardner, N. C. Briggs and G. S. Nash, of Hollister, are interested.

NEW COMPANIES.—East Side Water Supply Co., Hood River, Ore.; to supply water for irrigation purposes; $3,000; William F. Jackson, Levi Monroe, Virgil Winchel.

Willow Creek Fluming Co., Anaconda, Mont.; $20,000; Augustus A. De Kay.

Last Chance Ditch Co., Joliet, Carbon county, Mont.; $5,000; Andrew Nerlin.

Iowa Irrigation Ditch Co., Rapid City, Ia.; $25,000; Fred Albright, Farmingdale, Ia.; Clover Sickels, A. A. Newkirk, Wilson Marsh, Charles Bryan, Rapid City.

SEWERAGE.

ELLSWORTH, ME.—Surveys have been made for a system. F. W. Rollins and Henry W. Cushman, of the board of trade, are interested.

FARMINGTON, ME.—Jordon & Richardson, of Portland, have been engaged by the selectmen to make surveys for a system, according to reports.

BELMONT, MASS.—The town has voted to authorize the selectmen to make surveys for a system, and has voted to appropriate $1,000 for the expense of the surveys.

BOSTON, MASS.—We are informed that the street department has received the following bids for constructing sewers:

	Columbus Ave.	Commonwealth Ave.	St. Alphonsus St.
Quimby & Ferguson	*$9,700	.....	.....
D. F. O'Connell	9,785	$2,276	$5,146
D. O'Connell	10,331	1,979	4,507
H. P. Nann	10,648	.....	.....
D. E. Lynch	11,265	2,404	.....
Cralb & Trumbull**	11,860	.....	.....
Collins & Hans	13,344	.....	.....
J. Dolan	.....	*1,620	.....
J. Killiam	.....	1,982	.....
J. C. Coleman	.....	.....	*4,366

* Awarded contract.
** Winthrop, Mass.; all others Boston.

CAMBRIDGE, MASS.—The council has directed the city engineer to construct sewers in six streets.

THOMASTON, CONN.—The Thomaston Sewer Co. has been incorporated with a capital stock of $1,000 by Wm. Simpkin, E. C. Stroughton and S. J. Roberts.

BUFFALO, N. Y.—Bids are asked until Nov. 1 for constructing a 36-in. brick and 12-in. pipe sewer in Liberty St. R. G. Parsons, Secy. Pub. Wks.

DUNKIRK, N. Y.—Bids are asked until Nov. 5 for constructing pipe sewers in five streets. John F. Maloney, Cy. Clk.

KINGSTON, N. Y.—David Kennedy, Mayor, has vetoed the contract awarded to Campbell, Dempsey & Haines for constructing the Fourth and Ninth ward sewer system at $51,258, and has recommended that new bids be advertised for. The total of the bids was noted in our issue of Oct. 10. W. Klingberg, Cy. Engr.; Aug. Schepmoes, Cy. Clk.

MOUNT VERNON, N. Y.—Bids are asked until Nov. 4 for constructing a sewer in Elm St. Elias G. Pease, Cy. Clk.——The committee on public improvements is considering the question of a better sewer system. John F. Fairchild, Chn.

NEW BRIGHTON, N. Y.—Bids are asked until Nov. 5 for constructing sewers in two streets. J. F. O'Grady, Clk. Bd. Trustees.

NIAGARA FALLS, N. Y.—The council has voted to build a trunk sewer near the property of the Niagara Falls Power Co. at an estimated cost of $20,000.

SYRACUSE, N. Y.—Bids are asked until Oct. 28 for constructing a 60 × 40-in. brick and a 15-in. pipe sewer in North West St. and Belden Ave. H. F. Stephens, Cy. Clk.

TROY, N. Y.—Bids are asked until Oct. 29 for constructing a 12-in. pipe sewer in Frear Ave. E. Ogden Ross, Secy. Contracting Bd.

PLAINFIELD, N. J.—Bids are asked until Oct. 28 for the purchase of $100,000 of 4% sewer bonds. James T. McMurray, Cy. Clk.

NEW BRUNSWICK, N. J.—Bids will soon be asked for constructing a pipe sewer in Troop Ave. to cost about $4,000.

CARNEGIE, PA.—The council has directed the borough engineer to make a complete survey of the town for a sewer system.

PITTSBURG, PA.—Bids are asked until Oct. 26 for constructing 18 and 15-in. pipe sewers in nine streets and for 4,000 lin. ft. of sidewalk in Bluff St. Edward M. Bigelow, Dir. Pub. Wks.

YEADON, PA.—Albert Moore, Borough Clk., writes us that the proposed system has been postponed until the February election. In the mean time plans will be prepared and estimates made.

NEWPORT, KY.—W. L. Glazier, Cy. Engr., informs us that the following bids were received Oct. 16 for constructing sewers in three streets:

William White (awarded contract)	$1,244
Jas. J. Hastings	.....
Louis C. Ermert	.....
Jas. S. McLane	.....
Wilson & Strack*	.....

* Ninth and Plum Sts., Cincinnati, O.; all others Newport.

NORWOOD, O.—Bids are asked until Nov. 9 for constructing sewers in about 40 streets. J. M. Harper, Village Engr., Ninth and Plum Sts., Cincinnati; W. R. Wichgar, Village Clk.

GREENVILLE, O.—The council has voted to accept the report of John P. Force, Cy. Engr., of Fostoria, O., recommending the construction of a system at an estimated cost of $85,000, which includes a sewage disposal plant, to cost $14,000. The question will be voted on by the citizens in November.

SANDUSKY, O.—Bids are asked until Nov. 4 for constructing sewers in two streets. A. W. Miller, Cy. Clk.

TOLEDO, O.—Bids are asked until Nov. 4 and 11 for constructing sewers in six streets. L. P. Harris, Clk.

RICHMOND, IND.—Bids are asked until Nov. 1 for constructing a sewer. Joseph H. Winder, Clk. Pub. Improvements.

SOUTH BEND, IND.—Bids are asked until Nov. 11 for building pipe sewers in two streets. L. A. Hull, Cy. Clk.

KALAMAZOO, MICH.—Fred Cellem, Chn. Com., writes us that all that will be done in regard to the proposed system in ward 5 this winter will be preliminary surveys and maps. Engr., M. C. Taft.

BELVIDERE, ILL.—The council is considering an ordinance for constructing a system. A. E. Jenner, Clk.

CHICAGO, ILL.—Bids are asked until Oct. 28 for constructing a sewer system for the Chicago isolation hospital. W. D. Kent, Comr. Pub. Wks.——H. L. Gannett, Chn. Com., Moreland, writes us that the question of constructing the West 45th St. sewer system is in the court for confirmation, and if confirmed, bids can be asked by the city. As the question is greatly objected to, it is probable that it will be in the court for about a year before being confirmed. If it is not confirmed, a temporary system of about two miles in length will be asked for by the people of Moreland. The West 45th St. system will have 11 miles of 9 to 2-ft. brick sewers, with an average cut of 12 ft., and is estimated to cost $722,000.

MONTICELLO, ILL.—Ray S. Carberry, Cy. Engr., writes us that Carson & Co., of Danville, have the contract for constructing 15,000 ft. of 12 to 8-in. main pipe sewers, estimated to cost $5,000; average cut, 8 ft. About 2,000 ft. have already been constructed. Engr., A. N. Talbot, Champaign, Ill.

MADISON, WIS.—McClellan Dodge, Cy. Engr., and Capt. John Nader, having been appointed engineers by the city to jointly prepare plans and specifications for a system of sewerage and sewage disposal for that city, have reported a general plan of collection and disposal by chemical treatment, with additional purification by filtration, which has been approved. Part of the intercepting sewer (which will be over two miles in length) will be built, if possible, this fall, owing to unusually favorable conditions, the remainder of the work to be done next spring.

AUSTIN, TEX.—The Austin Sewerage Co. has been incorporated to construct a sewer system; capital stock, $150,000; incorporators, Geo. W. Littlefield, John J. Donovan, of Massachusetts; Frank Hamilton, John R. Doom, of Austin.

MARLIN, TEX.—R. M. & J. M. Odell have been granted permission to construct sewers.

SANTA MONICA, CAL.—The council has authorized issue of bonds for a system. C. S. Dales, Town Clk.

MONTREAL, QUE.—Percival W. St. George, Cy. Surv., has proposed that sewers be constructed as follows: Sherbrooke St., estimated cost, $149,300; St. Catherine St., $11,740; St. James St., $103,894; De Levis St., $139,469, and $10,000 for the extension of the main sewer now discharging into Elgin basin, making a total cost of $414,403.

HAMILTON, ONT.—Emil Kuichling, of Rochester, N. Y., has recommended to the committee the construction of an outlet sewer about 6,000 ft. into the bay. The estimates for the system are as follows: Intercepting sewer, $130,000; pumping station, $75,000; discharge pipe, $65,000. The operating expenses of the pumping station are estimated at $5,500 a year.

GARBAGE DISPOSAL.

NEWTON, MASS.—The board of health has submitted a report to the council recommending that a 65-ton garbage crematory be purchased, at a cost of $17,000. The mayor has indorsed the recommendation and a special committee is considering the report.

COLUMBUS, O.—The director of public safety is reported as about to ask for bids according to new specifications for collecting and disposing of garbage.

STREETS AND ROADS.

WARWICK, R. I.—Bids are asked until Oct. 29 for grading Kilbust St., Warwick. Engr., J. A. Latham, 87 Weybosset St., Providence; address Jas. P. Rhodes, 5 College St., Providence.

BALTIC, CONN.—Bids are asked until Nov. 2 for constructing a macadam road in Sprague. C. L. Hazen, Selectman, Baltic.

MILFORD, CONN.—E. L. Ford, Town Agent, Milford, writes us that the following bids were received Oct. 14 for macadamizing a road 2,000 ft. long:

	Per lin. ft.
Almon & Thomas Clark, Milford, Conn.	$1.65
John A. Doolittle & Co., New Haven, Conn.	1.60
R. Redfield & Son, New Haven, Conn.	1.33
Michael Mayer, Branford, Conn.	1.28½

SOMERS, CONN.—Bids are asked until Oct. 28 for macadamizing a road. H. C. Stinson, Selectman, Somersville, Conn.

VERNON, CONN.—Bids are asked until Nov. 1 for constructing a macadam road 4,500 ft. long. John E. Fahey, Rockville, Conn.

WATERBURY, CONN.—Bids are asked by the select-

men until Nov. 2 for constructing a macadam road, as stated in our advertising columns. Engr., W. G. Smith, Citizens' Bank Bldg., Waterbury.

ALBANY, N. Y.—The board of contract has received the following bids for granite block paving in Canal St.: B. F. & P. W. Mulderry, $14,511; William R. Reynolds, $13,948; T. Henry Dumary, $12,900; Edward F. Dillon, $13,678; Callanan Road Improvement Co., $13,196.

BROOKLYN, N. Y.—Bids are asked until Nov. 1 for repaving Furnam St., from Fulton St. to Atlantic Ave.; surety, $6,500. Alfred T. White, Comr. Cy. Wks.

NEW YORK, N. Y.—Bids are asked until Oct. 28 for granite block paving in two streets, and until Oct. 31 for asphalt paving in two streets. Wm. Brookfield, Comr. Pub. Wks.

YONKERS, N. Y.—Plans have been prepared for grading and macadamizing in six streets. Samuel L. Cooper, Comr. Pub. Wks.

MORRISTOWN, N. J.—Bids are asked until Oct. 28 for macadamizing 1,800 lin. ft. of road. Engr., Wm. E. King, Landing, N. J.; Jeremiah White, Freeholder, Morristown; Merritt B. Lum, Dir. Freeholders.

NEW BRUNSWICK, N. J.—Bids are asked until Oct. 28 for 2,000 sq. ft. of stone and cement sidewalk. B. R. Hagerman, St. Comr.

ORANGE, N. J.—Bids are asked until Nov. 4 for 3,000 sq. yds. of macadam paving, 700 sq. yds. cobblestone paving, etc. Louis D. Gallison, Chn. St. Com.; John P. Dexheimer, St. Comr.

SOUTH RIVER, N. J.—It is stated that the borough of South River will soon issue $10,000 in bonds for street improvements.

WOODBURY, N. J.—Bids are asked until Nov. 20 for building a stone road six miles long in Deptford township, Gloucester county, as stated in our advertising columns. Chas. W. Starr, Dir. Bd. Freeholders Gloucester county, Woodbury.

YOUNGSTOWN, PA.—Bids are asked until Nov. 1 for grading and macadamizing two streets. H. W. Calvin, Clk. Bd. Cy. Comrs.

SANDUSKY, O.—G. W. Miller, Cy. Clk., informs us that the following bids were received Oct. 12 for paving two slips, both bidders being of Sandusky: C. F. Hartman, Bolen block brick, $3,937; James Conley, Athens block brick, $3,594; Bolen brown granite brick, $3,639; Canton shale granite brick, $3,457; Harris paved granite brick, $3,594.

HUNTINGBURG, IND.—Bids are asked until Nov. 4 for paving several streets with brick. James Murray, Clk. Council.

INDIANAPOLIS, IND.—Bids are asked by the board of public works, until Oct. 29 for 7,455 sq. yds. of asphalt paving in Liberty St.

SOUTH BEND, IND.—Bids are asked until Nov. 11 for grading and paving two streets with brick. L. A. Hull, Cy. Clk.

TIPTON, IND.—Bids are asked until Nov. 2 for constructing a road. James L. Romack, County Surv.

CHICAGO, ILL.—Bids are asked until Oct. 29 for paving in 12 streets. W. D. Kent, Comr. Pub. Wks.

KANSAS CITY, MO.—Bids are asked until Oct. 31 for macadamizing 31st St. F. J. O'Flaherty, County Surv.

SAN ANTONIO, TEX.—It is stated that the council will soon vote on the question of issuing $50,000 in street improvement bonds.

SAN DIEGO, CAL.—Bids are asked until Nov. 4 for 74,000 sq. yds. of bitumen paving, estimated to cost $1 per sq. yd. Geo. D. Goldman, Cy. Clk., writes us that the pavement of the city is bituminous rock 2 ins. thick on natural earth foundation. Edwin M. Capps, Cy. Engr.

MANUFACTURING PLANTS.

FAIR HAVEN, MASS.—A press report states that a new weave mill will be located at this place, near the Coggeshall St. bridge; capital stock, $200,000; Treas., Dr. W. E. Brownwell.

NEW YORK, N. Y.—It is reported that Mauritz F. Westergren, 214 East 30th St., will build a three-story brick factory, 65 × 94 ft., on the north side of 114th St., to cost $25,000. Arch., W. G. Jones, 280 Broadway.

DANVILLE, PA.—The court has granted A. S. Patterson, receiver of the Mahoning Rolling Mill Co., of this place, an order to sell all the real estate belonging to the company, consisting of the rolling mill, machine shops, foundries, railways, machinery, and the interest of the company in the Enterprise Foundry & Machine Works. The sale will take place at Danville, Dec. 5.

PHILADELPHIA, PA.—The Mount Vernon Marble Co., it is stated, will establish a plant at the corner of 30th and Walnut Sts., and will erect a two-story building, to contain the machinery for the dressing and polishing of the stone.—Hales & Ballinger, Archs., will soon ask for estimates for a three-story addition 39 × 67 ft. to the buildings of the Stanton Mfg. Co., at 73d St. and Woodlawn Ave.

READING, PA.—Prince & Fuller will erect a three-story addition 30 × 55 ft. for the Reading Nickel Plating Works, on the west side of Maple St., between Spruce and Muhlenberg Sts.—Report states that J. H. Sternburgh & Sons, proprietors of the bolt and nut works, will erect a rolling mill, 80 × 200 ft., at Fourth and Buttonwood Sts.

SOUTH BETHLEHEM, PA.—A report states that Lehr, Leh & Nartz have made the plans for a new silk mill, to be erected at Fountain Hill. The building will be 240 × 145 ft.; R. Lipps, of the Lehigh mills, is the projector.

BERKELEY, VA.—The Norfolk Creosoting Co. will erect a large plant at Money Point, and will soon begin operations. The capital stock of the company is $50,000, and the incorporators E. H. Bull, Edmund Christian, T. H. Syron, R. A. Dodson and W. W. Tunis, all of Berkley, Va.

DANVILLE, VA.—The Riverside Mfg. Co., of this place, one of the largest cotton mill companies in the South, will build two new cotton mills, to be operated by water power, 90 × 400 ft., and 40,000 spindles capacity each. The company already operates six mills.

CHARLOTTE, N. C.—At a meeting of the directors of the Ada Cotton Mills Co., of this place, last Saturday, it was determined to expend $50,000 in equipping and building a weave addition to the present spinning mill. Over 100 looms will be put in to begin with. Pres., W. C. Mayer, Charlotte, N. C.

AIKEN, S. C.—A knitting mill to cost about $10,000 is to be built at this place in the near future.

CHARLESTON, S. C.—A hosiery mill is to be built and equipped at this place by the Bailey-Libby Co.

ROCK HILL, S. C.—Northern capitalists have in view the erection of a $100,000 cotton mill at this place.

MONTGOMERY, ALA.—Report states that the Hollinger Mfg. Co. has arranged to erect a dam and grist mill on Hollinger Creek in Baldwin county; the dam will alone cost $10,000.—At a public meeting recently held $100,000 was subscribed to the People's Cotton Factory; this is one-half of the capital stock, and the enterprise will now be pushed.

CHATTANOOGA, TENN.—S. M. Patton, Arch., is preparing plans for a new boiler and machine shop for the Casey-Hodges Mfg. Co., to be erected at an early date at a cost of about $20,000.

BRILLIANT, O.—A report states that the Brilliant Steel & Iron Co. is making a number of improvements to its plant; 22-in. and 16-in. skelp mills are being put in, and an extensive addition will be built to the pipe mill; contracts will be let for lap and butt weld furnaces, pipe rolls, threading and testing floors and machinery.

CANTON, O.—The board of trade met recently to consider the proposed removal of the Toomey Carriage Works, from Canal to Canton, where it is proposed to erect a structure to cost $12,000.

CLEVELAND, O.—Runyon, Stubb & Co. have bought the Anna Furnace plant at Struthers, O., and will equip the plant with modern machinery, and make other extensive improvements.—Isaac Levy, of the firm of Landesman & Hirschheimer & Co., will soon commence the erection of a five-story brick building on Huron St., to be used for the manufacture of gas fixtures.

HAMILTON, O.—It is reported that the firms of Ritchie & Dwyer, of Hamilton, and the Reeves Co., of Columbus, Ind., are about to consolidate and put up one of the largest engine and threshing machine works in the United States.

YOUNGSTOWN, O.—Gilbert B. Booth, John Tod, G. A. Doeright, Richard Garlick and J. H. Dunbar have bought out the Falcon Bronze Works and have filed articles of incorporation for the Falcon Bronze Co. The company will soon begin the erection of a plant 130 × 40 ft., two stories high, for which the contract has been awarded to Wm. Sprague, of this city; the foundry will be equipped with a Harrington traveling crane with a lifting capacity of 4,000 lbs., six melting furnaces, etc.

BREMEN, IND.—The Holland Radiator Works was recently destroyed by fire; reported loss, $150,000.

DU PERE, WIS.—It is understood that the water power flouring mill of John S. Dunham, which was recently burned, will be rebuilt; reported loss, $15,000; insurance, $12,000.

ST. PAUL, MINN.—J. W. Powers, of the Powers Triple Cylinder Engine Co., is about to establish a plant for manufacturing his new steam engines. The board of trade is considering the matter of furnishing $10,000 for the enterprise.

MINNEAPOLIS, MINN.—A report states that E. S. Woodworth & Co. will erect a $25,000 elevator at the corner of Elm St. and 22d Ave.

DENVER, COLO.—J. S. Clark has organized the Grand Junction Iron Foundry Co., of Grand Junction, Colo., and expects the plant to be running by December.

COLVILLE, WASH.—The Colville Roller Mills Co. has been incorporated, and will proceed at once to erect necessary buildings. John Hanley, John B. Slater and George H. Wissner are interested.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

OIL WELLS.—Alliance, O.—Bids are asked for drilling one to three wells in Jefferson county, O. I. Koch, Secy. Alliance Oil & Gas Co.

DREDGING.—New York, N. Y.—Bids are asked by the department of docks until Nov. 8 for about 100,000 cu. yds. of mud dredging in the North River.

DISINFECTING PLANTS.—Washington, D. C.—Bids are asked by the district commissioners until Oct. 30 for the erection of disinfecting plants at the new smallpox hospital.

FIRE HOSE.—Naples, N. Y.—Bids are asked by the board of water commissioners for 1,000 ft. of approved fire hose. F. X. Taaffe, Engr. in Charge; W. L. Pottle, Secy. Comrs.

CEMENT TESTING MACHINE.—Pittsburg, Pa.—Bids are asked until Oct. 26 for furnishing and delivering a cement testing machine, with one mold. Edward M. Bigelow, Dir. Pub. Wks.

PIER WORK.—Philadelphia, Pa.—Local papers state that Wm. P. Clyde & Co. have submitted a proposition to the city whereby they agree to spend $100,000 in pier extensions and improvements.

POWDER.—Washington, D. C.—Bids are asked until Nov. 18 for furnishing 580,700 lbs. of powder for siege and sea-coast guns, to be delivered at Dover, N. J., and Benicia Arsenal, Cal. Brig. Gen. D. W. Flagler, Ch. of Ordnance.

STEEL RAILS.—Ottawa, Ont.—Bids are asked until Dec. 17 for 1,000 tons of 50-lb. steel rails for Prince Edward Island Ry., and 3,000 tons of 67-lb. rails for the Intercolonial Ry. J. H. Balderson, Secy. Dept. Rys. & Canals.

GAS PLANT.—Buffalo, N. Y.—J. Edward Addicks, of Delaware, who owns the Queen City Gas Co.'s franchise, is in the city preparing to lay mains and furnish gas this winter. Contracts for the work will probably be let within a few days.

STATE CANAL WORK.—Albany, N. Y.—Bids are asked until Oct. 31 for dredging lower Black Rock Harbor at Buffalo, and for extending the dyke protecting property adjacent to the Chemung River at Corning. Geo. W. Aldrich, Supt. Pub. Wks.

FILLING, ETC.—Brooklyn, N. Y.—The Brooklyn & Rockaway Beach R. R. Co. has been given a grant of about five acres of land under water, in front of its present property at Canarsie. It is stated that this will be filled in, docks built and other extensive improvements made before next summer. The docks of the town of Flatlands at this place will be moved further west and entirely rebuilt. Gen. Supt., Wm. Warner, Canarsie, N. Y.

TELEPHONE LINE.—Long Branch, N. J.—A press report states that the New York & New Jersey Telephone Co. has acquired the rights along the shore front from Point Pleasant to Atlantic Highlands for the construction of a new telephone line, with three additional exchanges. The line is being built under the direction of D. Lane Conover, of Atlantic Highlands, and P. Hall Parker, of Seabright. They expect to have it in operation by the middle of next month. Beside touching all the sea-coast towns, this line also will tap the important inland towns of Keansbury, Port Monmouth, Red Bank, Keyport, South Amboy and Perth Amboy, and go on across the Kills by cable to Staten Island, and thence into New York.

CONTRACT PRICES.

BRICK PAVING.—East St. Louis, Ill.—L. L. Harper, Cy. Engr., writes us that the following bids were received Oct. 12 for the improvement of two streets:

Quantities.	McCabe & Hill, Union Trust Bldg., St. Louis.	Nelch, Patteson & Striffler, Springfield, Ill.	Vlethis, Rockert & Skvalnka, St. Louis, Mo.	Hill-O'Meara Construction Co., St. Louis, Mo.	A. & J. C. Heman, St. Louis, Mo.
Ninth St.:					
Filling ..... 6,600 cu. yds.	$0.32	$0.395	$0.37	$0.34	$0.37
Excavation ..... 2,000 " "	.17	.125	.25	.15	.10
Limestone curbg, 4,800 ft.....	.41	.41	.41	.38	.40
Paving, Wabash brick:					
On brick ....10,000 sq. yds.	1.44	1.39	1.51	1.28	1.20
On 5 ins. novaculite	1.36	1.26	1.47	1.23	1.25
On 8 ins. macadam	1.32	....	1.45	1.21	1.15
Galesburg repressed, on brick..	1.44	1.30	1.40	1.26	1.13
On 5 ins novaculite	1.36	1.19	1.36	1.21	1.18
On 8 ins. macadam	1.32	1.23	1.34	1.19	1.08
Galesburg standard on brick..	.....	.....	1.37	.....	1.03
On 5 ins. novaculite	.....	.....	1.33	.....	1.15
On 8 ins. macadam	.....	.....	1.31	.....	1.10
"Anderson & Barr," on brick.	1.34	.....	1.35	.....	1.05
On 5 ins. novaculite.....	1.26	.....	1.31	.....	1.10
On 8 ins. macadam	1.22	.....	1.32	.....	1.00
St. Louis Prsd. Bk. Co., on brick	.....	.....	1.43	1.25	1.20
On 5 ins. novaculite	.....	.....	1.39	1.20	1.18
On 8 ins. macadam	.....	.....	1.37	1.18	1.08
Springfield Pav. B. Co., on brick	.....	.....	.....	.....	1.20
On 5 ins. novaculite	.....	.....	.....	.....	1.25
On 8 ins. macadam	.....	.....	.....	.....	1.15
Illinois Ave.:					
Filling ..... 8,000 cu. yds.	$0.32	$0.395	$0.37	$0.34	$0.37
Excavation ..... 600 " "	.17	.125	.25	.15	.10
Limestone curbg, 3,900 ft.....	.41	.41	.41	.38	.40
Paving, Wabash brick:					
On brick ....11,200 sq. yds.	1.44	1.39	1.51	1.28	1.20
On 5 ins. novaculite	1.36	1.26	1.47	1.23	1.25
On 8 ins. macadam	1.32	....	1.45	1.21	1.15
Galesburg repressed, on brick..	1.44	1.30	1.40	1.26	1.13
On 5 ins novaculite	1.36	1.19	1.36	1.21	1.18
On 8 ins. macadam	1.32	1.23	1.34	1.19	1.08
Galesburg standard on brick..	.....	.....	1.37	.....	1.03
On 5 ins. novaculite	.....	.....	1.33	.....	1.15
On 8 ins. macadam	.....	.....	1.31	.....	1.10
"Anderson & Barr," on brick.	1.34	.....	1.35	.....	1.05
On 5 ins. novaculite.....	1.26	.....	1.31	.....	1.10
On 8 ins. macadam	1.22	.....	1.32	.....	1.00
St. Louis Prsd. Bk. Co., on brick	.....	.....	1.43	1.25	1.20
On 5 ins. novaculite	.....	.....	1.39	1.20	1.18
On 8 ins. macadam	.....	.....	1.37	1.18	1.08
Springfield Pav. B. Co., on brick	.....	.....	.....	.....	1.20
On 5 ins. novaculite	.....	.....	.....	.....	1.25
On 8 ins. macadam	.....	.....	.....	.....	1.15

ASPHALT PAVING.—Indianapolis, Ind.—The following bids were received Oct. 5 for asphalting Ash St., 610 × 27 ft., 1,943 sq. yds. of asphalt on 6-in. Portland cement concrete foundation, 1,228 ft. of straight curb, 50 ft. of granite round corners, 114 ft. of marginal stone, and four inlets: Indiana Bermudez Asphalt Co., $4.83 a lin. ft. of each side of the street; Western Paving & Supply Co., $4.76; Warren-Scharf Asphalt Co., $4.62. The bids were rejected as too high, and new bids will be received Oct. 24. Bids were received Oct. 12 for asphalting Alabama St. in two sections. One section is 2,296 × 40 ft., and has 10,751 sq. yds. of asphalt on 6 ins. Portland cement concrete foundation, 4,260 sq. yds. on 6 ins. broken stone under the street railway tracks, 51 sq. yds. of resurfacing asphalt, 4,461 ft. of straight curb, 317 ft. of granite round corners, 206 ft. of marginal stone, 3 catchbasins and 26 inlets. The Warren-Scharf Co. bid $7.75 per lin. ft. of each side of the street; the Indiana Bermudez Co., $7.58, and the Western Paving & Supply Co., $7.45. The other section is 1,313 × 40 ft., and has 4,840 sq. yds. of asphalt, 2,436 sq. yds. of broken stone under tracks, 2,373 ft. of straight curb, 229 ft. of granite round corners, 229 ft. of marginal stone, and 12 inlets. The Western Paving & Supply Co. bid $6.17 a lin. ft. of each side of the street; the Indiana Bermudez Co., $6.08, and the Warren-Scharf Co., $6.03. All bids on both sections were rejected, and bids will be again received Oct. 26, the work to be done next year. The Capitol Paving & Construction Co. presented bids on California asphalt, but they were returned unopened, as their material is unknown to the board of public works.

CAST IRON PIPE.—Jacksonville, Fla.—R. N. Ellis, Supt., writes us that the following bids were received Oct. 15 for a supply of cast iron pipe, as advertised in Engineering News, (1) being price per ton of 2,000 lbs. for 4,050 tons of 20 to 4-in. coated water pipe; (2) price for 705½ tons of 24 to 8-in. light cast iron coated sewer pipe; (3) price per ton of 2,000 lbs. for 85 tons of special castings:

	1.	2.	3.	Total.
Standard Sup. & Mach. Co.....	$22.00	$22.00	$50.00	$108,093
So. Pittsburg (Tenn.) P. & F. Co.	21.40	.....	50.00	.....
Warren Foundry & Mach. Co...	21.60	22.25	45.00	107,025
Howard-Harrison Iron Co.....	19.00	20.00	45.00	94,996
McNeal Pipe & Foundry Co.....	19.19	19.19	45.00	94,819
Chattanooga Pipe & Foundry Co.	21.20	22.00	42.50	104,753
William A. Bisbee, Jacksonville	19.98	19.98	45.00	98,860

WATER-WORKS.—Myerstown, Pa.—Edgar B. Kay, of Bellwood, Pa., has been awarded the contract for constructing water-works at this place, at the following prices, all pipe in streets to have 3 ft. of covering, and outside of streets, 2½ ft.: 8-in. cast iron pipe, 45-lb.,

7,494 ft., 70 cts. per ft.; 6-in., 30-lb., 4,221 ft., 55 cts.; 4-in., 20-lb., 15,754 ft., 44 cts.; 4-ft. double-nozzle hydrants, $25 each; 4-in. gate valves, $7.50 each; 6-in., $12; 8-in., $18; valve boxes, 23, $3 each; distributing chamber, $75; reservoir, $1,200.

SEWERS.—Rochester, N. Y.—The contract for a 12-in. vitrified pipe sewer in South Ave. has been awarded to John Mauder, the bids being as follows:

Bidder.	12-in. pipe, 1,400 ft.	29 Y-branches.	Manholes, 5	Total.
John Mauder	$0.00	$0.80	$30.00	$1,013
Wm. H. Jones & Sons	.70	.70	30.00	1,150
Chambers & Casey	.76	.70	30.00	1,234
S. J. Wagoner	.77	.52	40.00	1,293
Brayer & Albaugh	1.35	1.00	45.00	2,144

BULKHEAD WALL.—Brooklyn, N. Y.—W. E. Belknap, Engr., Wallabout Improvement, writes us that the following bids were received Oct. 10 for constructing the Clinton Ave. bulkhead wall, as advertised in Engineering News, the work including 900 lin. ft. of wall, comprising approximately 329,000 B. M. ft. yellow pine, all sizes; 482,500 B. M. ft. yellow pine sheet piling, 12 × 12 ins., grooved; 40,000 B. M. ft. white pine splines or tongues, 3 × 4 ins.; 2,230 pine and spruce piles; 127 white oak fenders; 45,000 lbs. wrought iron, bolts, spikes, etc.; 24,000 lbs. cast iron, mooring posts, etc.; 2,275 cu. yds. concrete; 980 lin. ft. coping; 27,500 cu. yds. excavation; 17,500 cu. yds. backfilling:

Bidder.	Per lin. ft.
Evans & Moore, Philadelphia	$74.90
Benner & Opdyke, Philadelphia	83.38
Arthur McMullen & Co., New York city	84.50
Stratford & Hawkes, Brooklyn	89.13
Sandford & Stillman Co., Jersey City	89.75
C. McLean, New York city	92.00
J. D. Leary, New York city	109.00

SEWER PIPE.—Jacksonville, Fla.—R. N. Ellis, Supt., writes us that the following bids were received Oct. 15 for furnishing sewer pipe, as advertised in Engineering News:

Quantities. Pipe.		Wm. A. Bisbee, Jacksonville, Fla.	Frost Sewer Pipe Co., Macomb, Ill.	Union Sewer Pipe Co., Akron, O.	Lookout Sewer Pipe Co., Chattanooga, Tenn.	A. W. Sewall, Pittsburg, Pa.
8-in.,	154,000 ft.	$0.11¾	$0.16	$0.11	$0.096	$0.12
10-in.,	9,000 "	.18¾	.24	.17	.135	.174
12-in.,	8,200 "	.21¼	.30	.22	.18	.22¾
15-in.,	4,500 "	.31¼	.45	.33	.265	.334
20-in.,	1,300 "	.70	1.25	.75	.55	.82½
24-in.,	2,060 "	.96	1.50	1.15	.82	1.194
8 × 15-in.	Y's, 4,600.	.51	.58	.45	.42	.543
10 × 5-in.	Y's, 350.	.80	.81	.60	.60	.78½
12 × 6-in.	Y's, 370.	.95	1.05	.85	.70	1.0245
15 × 6-in.	Y's, 50.	1.40	1.55	1.20	1.20	1.506
8 × 8-in.	T's, 500.	.50	.55	.50	.42	.543
10 × 8-in.	T's, 15.	.80	.81	.60	.60	.78½
12 × 8-in.	T's, 5.	.95	1.05	.85	.70	1.0245
15 × 8-in.	T's	1.40	1.55	1.20	1.20	1.506
8-in.	¼-bends, 200.	.45	.55	.39	.35	.486
10-in.	" " 24.	.68	.70	.70	.55	.735
12-in.	" " 12.	.87	1.00	.90	.75	.936
Totals		$29,250	$39,849	$28,126	$23,847	$30,589

METAL MARKET PRICES.

LEAD.—New York, 3.35 to 3.37 cts. Chicago: 3.15 to 3.17 cts. St. Louis: 3.1 to 3.15 cts.

BARB WIRE.—Pittsburg: $2.70 and $2.80 for galvanized, and $2.30 and $2.40 for painted in carload and less than carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $12 to $14.50. Pittsburg: $13 to $15.25. Chicago: $13 to $15.50.

TRACK MATERIAL.—New York: angle bars, 1.45 to 1.5 cts.; spikes, 1.8 to 1.85 cts: track bolts, 2.15 to 2.25 cts. with square, and 2.25 to 2.4 cts. with hexagon nuts. Chicago: angle bars, 1.65 to 1.8 cts.; spikes, 1.9 to 2 cts.; track bolts, 2.3 to 2.45 cts. with square and 2.5 to 2.6 cts. with hexagon nuts.

NAILS.—Pittsburg: $2.25 per keg for carload lots and $2.35 for less than carload lots, for wire nails at mill; $1.80 and $1.85 for cut nails at mill. Chicago: $2.40 and $2.50 for wire nails, $2 and $2.05 for cut nails. New York: $2.40 and $2.50 for wire nails, and $1.95 and $2.05 for cut nails.

RAILS.—New York: $28 at eastern mills and $28.75 at tidewater; old rails $16 to $16.50 for iron, and $13 to $13.50 for steel; light rails, $29; girder rails, $26. Pittsburg, $28 for standard sections of 45 lbs. and over; $28 for light sections; old rails, $19.75 for iron and $17 for steel. Chicago: $29 to $31 for standard sections; $28 for light sections; old rails, $17.50 to $19 for iron, and $13 to $15 for steel.——Trade reports state that orders have been placed recently for nearly 150,000 tons of rails, for delivery during 1896. The Pennsylvania R. R. placed its annual order for 40,000 tons, dividing the same between the Carnegie, Illinois, Cambria and Pennsylvania steel companies. The Baltimore & Ohio R. R. contracted for 20,000 tons, and one southern order for 25,000 tons was also placed, besides a number for smaller quantities. The prices were on the basis of $28 per ton f. o. b. Pennsylvania mills, and $29 f. o. b. Chicago, or the rates adopted by the rail manufacturers' association.

STRUCTURAL MATERIAL.—New York: beams, 1.75 to 2.1 cts.; channels, 1.85 to 2 cts.; angles, 1.65 to 1.8 cts.; tees, 1.9 to 2 cts.; universal mill plates, 1.85 to 1.95 cts.; steel plates, 1.85 to 2 cts. for tank, 2 to 2.1 cts. for shell, 2.1 to 2.25 cts. for flange, 2.4 to 2.5 cts. for ordinary firebox, 2.6 to 2.75 for locomotive firebox. Pittsburg: beams, 1.6 to 1.9 cts.; channels, 1.6 to 1.9 cts.; angles, 1.5 to 1.6 cts.; tees, 1.6 to 1.65 cts.; Z-bars, 1.6 to 1.65 cts.; universal mill plates, 1.8 to 1.9 cts.; steel plates, 1.7 to 1.8 cts. for tank, 1.8 to 1.9 cts. for shell, 1.9 to 2 cts. for flange, 2.5 cts. for ordinary firebox, 2.5 to 4 cts. for locomotive firebox. Chicago: beams, 1.8 to 1.9 cts.; channels, 1.8 to 1.9 cts.; angles, 1.75 to 1.85 cts.; tees, 1.95 to 2 cts.; universal mill plates, 2.05 to 2.15 cts.; steel plates, 2 to 2.15 cts. for tank, 2.35 to 2.5 cts. for flange, 2.8 to 2.9 cts. for ordinary firebox, 4.5 to 4.75 cts. for locomotive firebox.

INDUSTRIAL NOTES.

THE NILES TOOL WORKS CO., of Hamilton, O., has received an order from the E. W. Bliss Co., of Brooklyn, N. Y., for eight heavy iron planers.

THE BROWN HOISTING & CONVEYING MACHINE CO., of Cleveland, O., has sold to the Bates Machine Co., of Joliet, Ill., a 20-ton electric overhead crane.

THE UNION BOILER WORKS, of Fredericksburg, Pa., is reported as having failed. The liabilities of Jacob H. Grove, the proprietor, are estimated at $100,000.

THE FLUSH TANK CO., of Chicago, Ill., is furnishing flush tanks for Peoria, Ill.; Ann Arbor, Mich.; Williamsport, Pa., and Richmond, Ind. The company is also furnishing siphons in small quantities to a large number of small towns.

THE FRUIN-BAMBRICK CONSTRUCTION CO., of St. Louis, Mo., has finished its new plant at Long Island, N. Y., and a full force of men is at work in the manufacture of asphalt. The company is now laying asphalt pavement on McDonough and South Ninth Sts., Brooklyn, N. Y.

CHAS. McFADDEN & SONS, railway contractors, of Philadelphia, Pa., have been awarded the contract for the construction of the Philadelphia, Bustleton & Trenton R. R., between the junction with the New York Division of the Pennsylvania R. R., near North Penn Junction, to a point near Oxford Pike, a distance of about three miles.

THE SECKNER CONTRACTING CO., Unity Bldg., Chicago, has been awarded the contract for putting in a complete system of water-works at Crown Point, Ind., including stand-pipe, pumping station, pumps and boilers, wells and 5 miles of mains; cost, $36,000. Mr. Brown informs us that they are also putting in complete works at Alexandria and Fowler, Ind.

THE UNION AKRON CEMENT CO., of Buffalo, N. Y., is furnishing a car-load of cement per day for the new court house at Warren, O. It is also furnishing cement for the new buildings at the State Hospital for the Insane, at Willard, N. Y.; for street paving in Detroit, Mich.; Rochester and Albany, N. Y., and for a dam across the Oswego River at Oswego, N. Y.

THE PITTSBURG & CLEARFIELD COAL, STONE & MINERAL CO., of Pittsburg, Pa., will erect a fire-brick works near Clearfield, where a rich vein of fire-brick clay has been found; the company is now preparing to drill a gas well, and to erect a sawmill and a mill for cutting stone into shape for building purposes. Mr. Barrick, of the Twin Cities Building Loan Assoc., of Pittsburg, Pa., is largely interested.

THE AMERICAN STEEL FOUNDRY CO., 509 Olive St., St Louis, Mo., E. F. Goltra, Gen. Man., reports that owing to the increased demand for its American steel truck for freight cars and tenders, it has been obliged to make large extensions, including a new building, 375 × 250 ft., in which several new furnaces will be built. The Koken Iron Works, St. Louis, has the contract for the ironwork for the new building.

THE BECKETT FOUNDRY & MACHINE WORKS, of Arlington, N. J., is building for the Chickier Iron Co., of Silver Spring, Pa., a magnetic concentrating plant using two Buchanan 30-in. crushers, two sets Buchanan steel crushing rolls, screens, elevators, shafting, etc., and one 100-HP. Corliss engine and a high-speed engine for driving dynamo and magnetic separators. The company is also building for the Wayland Portland Cement Co. a complete crushing plant, to be equipped with Buchanan crusher and rolls.

T. H. RISDON & CO., of Mount Holly, N. J., are building for the Pejepscot Paper Co., Brunswick, Me., one set of four 36-in. register gate wheels on one horizontal shaft in a steel outer case; these wheels develop 550 HP. under 20-ft. head, and are an addition to the seven sets of the same design now in use, making a total of 4,400 HP. developed by Risdon turbines in this mill. Messrs. Risdon & Co. also have in hand for John E. Morehouse, Paterson, N. J., a 30-in. cylinder gate wheel in an iron outer case, with a quarter turn to develop 125 HP., under 24-ft. head.

NEW COMPANIES.—Edwards Mfg. Co., Newark, N. J.; $500,000; address Newkirk Wentz, Newark, N. J.

Allen & Cram Machine Co., Raleigh, N. C.; $10,000; G. M. Allen and W. C. Cram, of Raleigh.

Eastport Lighting Co., Eastport, Me.; $50,000; Pres., Wm. A. Carey, Malden, Mass.; Treas., W. H. Whitney.

Schofield Bolt Co., Anderson, Ind.; $120,000; A. B. Bower, F. R. Schofield, B. P. Bower, and W. C. Schofield.

Massachusetts Car Co., Ashburnham, Mass.; $150,000; Pres., Edward Records; Treas., John W. McIntosh, of Ashburnham.

Heidenreich Construction Co., Chicago, Ill.; $25,000; Michael H. Geurin, Isaac H. Mayr and E. Lee Heidenreich, of Chicago.

The Mooman Car Coupler Co., Salem, Va.; Pres., P. C. Stearns; Treas., H. C. Mooman; Secy., James Wylie, all of Salem.

The Webster Gulch Copper Mining Co., Globe, Ariz.; $2,000,000; Leo Crandall, J. B. Henry, W. H. Beard and others, of Globe.

Homestake Consolidated Mining Co., Spokane, Wash.; $500,000; Walter L. Blossom, F. E. Elmendorf, C. M. Cheney and Arthur Townsend.

Hardie-Tynes Foundry & Machine Co., Birmingham, Ala.; $20,000; Wm. Hardyoof, of Birmingham, Ala., and W. D. Tynes, of Corinth, Miss.

Wicke & Reinhardt Car Fender Co., Brooklyn, N. Y.; $10,000; Philip Reinhardt, O. A. Wicke, F. W. Craw and others, of Brooklyn, N. Y.

Wm. Lindeke Roller Mill, St. Paul, Minn., $25,000; Frank W. Lindeke, Gustave T. Schurmeier and Theodore A. Schulze, all of St. Paul.

Main Quesnelle Gold Dredging & Mining Co., Tacoma, Wash.; $250,000; Robert Thompson, E. J. Eader, H. K. Read and F. B. Fox, of Tacoma.

Norfolk Creosoting Co., Berkely, Va.; to operate a plant at Money Point; $50,000; E. H. Bull, Edmund Christian, P. H. Syron and others.

Holton Electric Co., Holton, Kan.; $10,000; Clarence A. Ross and W. H. Blood, Jr., of Kansas City, and Lark T. Bonebrake, of Holton, Kan.

The Chaquette Power Co., Bridgeport, Conn.; for compressing air for supplying refrigerators; $75,000; Daniel Davenport, Ephraim Chaquette.

The Electric Flameless Stove Co., New York, N. Y.; $500,000, with $250 paid in; J. L. Follett, H. S. Follett, D. F. Pond and others, of New York.

Stewart Contracting Co., Columbia, S. C.; $40,000; J. E. Burgess, of Savannah, Ga.; A. R. Stewart, Thomas J. Harper and Wm. Lyles, of Columbia.

Universal Elevator Co., Detroit, Mich.; $100,000, with $60,000 paid in; Charles W. Moore, Marvin M. Stanton, Frank E. Schoomacher and others, of Detroit.

The National Capital Filter Co., Harpers Ferry, W. Va.; $25,000, with $60 paid in; Wm. Marche, J. M. York, C. C. Wilkinson, and others, of Washington, D. C.

California Road Machine Co., San Francisco, Cal.; $300,000, with $50 paid in; J. B. Jardine, Thomas D. Poole, C. W. Gammon and others, of San Francisco.

The Eclipse Bicycle Co., Horseheads, Chemung county, N. Y.; $200,000; Herman H. Fulton and Albert D. Long, of Elmira, and David C. Whittier, of Indianapolis, Ind.

T. C. Dill Machine Co., Philadelphia, Pa.; to manufacture iron and steel; $10,000, with $1,000 paid in; address Charles S. Walton, St. Davids, Delaware county, Pa.

General Railway Equipment Co., Chicago, Ill.; $100,000; Harlow M. Higginbotham, Ellphalet W. Cramer, James H. Long and Harry M. Higginbotham, of Chicago.

Home Telephone Co. of Jersey City, Jersey City, N. J.; $300,000, with $100,000 paid in; Ernest J. Foord, P. Justus Atkinson and George H. Atkinson, all of Jersey City.

Eddystone Mfg. Co., Philadelphia, Pa.; to manufacture textile goods; $1,000,000; Wm. Simpson, Jr., Lincoln Godfrey, John Fraley and others, of Philadelphia.

Poorman Gold Mining Co., Spokane, Wash.; $500,000; J. H. Coram, of Lowell, Mass.; C. H. Palmer and C. S. Warren, of Butte, Mont.; Patrick Clark and others, of Spokane.

The Canton Buff Brick Co., Canton, O.; to manufacture brick, stoneware, sewer-pipe, etc.; $60,000; Joseph Weaver, L. M. Barrick, F. H. Belden and others, of Canton.

Standard Car Truck Co., Jersey City, N. J.; $150,000, all paid in; B. Franklin Cronkrite, Chicago, Ill.; Chas. D. Thomson, Montclair, N. J.; Frank H. Hall, Jersey City, N. J.

The Squaw Lakes Water & Mining Co., San Francisco, Cal.; $1,152,000; fully subscribed; J. W. Northup, John Knox, William Knox, W. W. Thayer and others, of San Francisco.

National Coal Mining Co., Portland, Ore.; to do a general mining and improvement business, etc.; $220,000; J. B. Parker, F. M. Batchelor, J. S. Stephenson and others, of Portland.

Imperial Mining & Smelting Co., Joplin, Mo.; $100,000; J. H. Dangerfield, Joplin, Mo.; L. C. Pitner, Evansville, Ill.; O. H. Balbridge, Chicago, Ill., and John A. Strong, of Webb City, Mo.

The MacCormack Water Tube Boiler Co., Bayonne, N. J.; $500,000, with $1,000 paid in. James MacCormack and Ralph C. Swan, of Bayonne, N. J., and John McDougall, of Brooklyn, N. Y.

Polish Lithuanian Brewing Co., Danville, Pa.; $75,000; Simon Savage, of Nanticoke; John Jukosh, of Plymouth; P. H. Coyne, of Scranton, Frank Kone, of Wilkes Barre, Pa., and others.

The Kidd Bros. & Burger Steel Wire Co., McKee's Rocks, Pa.; $50,000; Rutherford Burger, of Sharpsburg, Pa.; J. C. Burger, of Pittsburg, and W. S. Kidd and Wm. Kidd, of McKee's Rocks.

United Wood Gas Co., East Orange, N. J.; to manufacture gas and machinery; $30,000; W. L. Quintard, George S. Dearborn, 104 Wall St., New York city, and W. S. Douglas, Jersey City, N. J.

Californi Road Machine Co., San Francisco, Cal.; $200,000, with $50 paid in; J. B. Jardine, Arthur Mercer, of San Francisco, Thomas W. Poole, of Alameda, and M. C. Gammon, of Walnut Grove.

Oil Lake Fuel Co., Los Angeles, Cal.; to develop lands, oil wells, construct canals, flumes, etc.; $300,000, all paid in; John L. Van Every, C. B. Van Every, H. M. Pomery, and others of Los Angeles.

The Peninsular Brass Co., Grand Rapids, Mich.; to manufacture metal goods, etc.; $5,000, with $4,880 paid in; Henry P. Hughes, John C. Hobson, M. W. Shaw, and Charles L. Frost, of Grand Rapids, Mich.

Pocono Spring Water Ice Co., Naomi Pines, Monroe county, Pa.; to build a dam on Tunkhannock Creek for ice purposes, fishing, boating, etc.; $100,000; Frank C. Miller, Rufus M. Miller, Charles Hay, and others, of Pocono.

The Puerto Padre Co., Jersey City, N. J.; to open and develop mines, build wharves, steam and electric railways, etc., in Cuba; Edmund F. Harding, Brooklyn, N. Y.; Thomas F. Lennon, Stapleton, N. Y., and Jos. J. Schmidt, New York, N. Y.

TAXPAYERS ARE INTERESTED.

A press report from Lyndonville, Vt., reads as follows:

"The contractors have completed the water-works. The total cost was $36,143. Instead of exceeding the estimate, the actual cost has been $4,000 or $5,000 less."

This work was advertised in Engineering News, and the contract awarded to a regular reader of this paper.

A Michigan paper says:

"The Northville water-works cost $41,892, some $6,000 above the estimated cost, and of this amount the Northville 'Record' estimates that $15,000 was for experience. Northville is not the first town that has paid dear for experience."

Please note that the Northville work was not advertised in Engineering News; the contract was not awarded to a subscriber of this paper, and there is not a resident of Northville, Mich., who is a subscriber to Engineering News.

CONTRACT WORK

of all kinds, and in any section of the United States or Canada, should be advertised in Engineering News which is probably read by a greater number of prominent contractors each week than are any other five papers in this country.